Electrical World

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Concentration of Electrical Generation

ACCORDING to the Bureau of the Census the combined output of the 5521 central stations of the United States was a little over 11,500,000,000 kw-hr. in 1912. Last year the output approximated 14,000,000,000 kw-hr. Data published in our news columns this week show that 70 per cent of this output was generated by a very few companies, illustrating clearly to what extent the production of electricity is being concentrated in this country. Approximately 12,000,000,000 kw-hr. was generated last year by the thirty-six largest companies in the United States and Canada, of which, making allowances for duplication and for energy used in Canada, 10,000,000,000 kw-hr. was used in the United States. Of special interest are the tremendous output of the Commonwealth Edison Company of Chicago, which alone exceeded 1,000,000,000 kw-hr., and the exceedingly high load-factor of the Hydraulic Power Company of Niagara Falls, which is given as 91.7 per cent. Outside of Niagara Falls, with its electrochemical industries, the highest load-factors predominate on the Pacific Coast. There, with no such manufacturing enterprises as exist in the East and with a lesser density of population, the electric utilities have developed their territories to better effect.

Revision of Overhead Crossing Specifications

THE national joint committee on overhead and underground line construction is about to revise the existing standard specifications for electric-wire crossings, and it behooves central stations to make known at this time their objections to the specifications. No document of the National Electric Light Association has been more bitterly assailed by the electric companies of the country than has the report of the overhead-line committee, and yet no committee has been more painstaking in its labors and none other has devoted so much time to the consideration of its subject. At the very outset, however, the committee erred in failing to consider the legal aspects of so important a document, and the association erred in accepting construction specifications which have proved themselves to be a handicap to the industry. In the first report the voltage of the circuit was the sole criterion of safety, whereas the question was one of construction and not merely of voltage. All references to voltage limitation were removed last year, but the evil effects are not so readily wiped away. There can be no doubt about the adequacy of the report for thickly settled communities, but it ignores entirely the conditions in different sections of the country, so that it creates a heavy and unjustifiable burden upon the industry in certain sparsely settled sections. While due provision should in all cases be made for safety, provision should also be made for various grades of construction, and in this respect alone the report is sadly lacking. Whether a crossing be on a road in the wilderness where snow, sleet and wind are unknown or whether it be in one of the most densely populated districts of the country, the construction called for is identical. Such a requirement is not insisted upon in interior wiring nor should it be in exterior work. It would seem as though discretion could be relied on in the interpretation of the specifications, but such unfortunately is not the case. The way in which the report has been interpreted and applied is the chief cause for criticism, and the industry should insist that the revision be thorough and without bias. If this is the criterion by which construction is to be judged, it is well that serious and prompt consideration be given to it.

The N. E. L. A. and Good Service

THE recent attack of Mr. M. L. Cooke, of Philadelphia, against utilities was, of course, aimed indirectly against corporate interests. Made before an audience at Harvard University, a hearing was assured. It is receiving public attention as the view of the director of public works of Philadelphia and of the acting director of the Public Utilities Bureau. Mr. Cooke evidently did not care whom he hit. Public utility associations were his principal target, but bankers, educators, commissions, electrical manufacturers alike were under his displeasure, for the apparent reason that he links them with the corporate interest. Such an attack is interesting, but it imposes upon the listener. Notwithstanding contrary assertions, the chief activities of the National Electric Light Association relate to operation, economy, efficiency, technical progress and development. In these matters, necessarily subordinate to public policy because good service depends upon them, are the foundation of much helpful, constructive work of the association.

New York Commission Overburdened

AMONG the serious counts in the indictment of the legislative investigating committee against New York commissioners are the long time required to decide cases, the apparent slow handling of complaints, and the lack of prosecution for violations of transportation service orders. The evidence and the report reveal clearly that the First District commission was overburdened with responsibility in its dual function of regulator and supervisor of rapid-transit construction. If

regulation in Greater New York alone is not enough for any one commission, to direct the construction of a vast system of subway and elevated lines is undoubtedly as much as a single body of five men can do well. The commission in New York City suffered from too many activities. Charges of slow handling of complaints and formal cases can be made against almost every court and commission with probably as much, or almost as much, justice as in the New York case. Authorities do not make a practice of delaying action, but they wait until they are sure of all facts. If commissions and corporations had more confidence in each other, delays would be shorter.

Vital Problems in Regulation

Holding that relations between the public and public utilities are the most vital of all present economic problems, Mr. Theodore N. Vail, in his report to American Telephone & Telegraph Company shareholders, does not attack regulation, but he says truly that the present economic unsettlement cannot continue indefinitely. The sudden rise of the United States to wealth and power is stranger than fiction or than most history. That this magnificence has been created "by or because of" "means of intercourse and interchange" is beyond need of proof. The important point is that in great measure maintenance and continued growth of prosperity will be dependent upon "maintenance and continued growth of the utilities." To the extent that they have been a factor heretofore they must be a factor in a prosperous future. To the extent that they fail to be as much of a factor in the future as they have been in the past the future will fail to be as prosperous as it might be made by just, fair treatment of the utilities. Construction programs now have less assurance than formerly, being based more on the answer to the question "Will the extension pay from the beginning?" This restrictive attitude, costly to the public, retards seriously the normal upbuilding which fits plants for future larger population and inevitable demands.

Mr. Vail depicts the coincident passing of rule of thumb and the dawn of scientific operation, which has already attained maximum results in some industries, but does not mention the fact that for many benefits voluntarily introduced the public authorities, liking the political effect, have seized full credit. The element of danger is that there cannot be permanent decreases in earnings and increases in expenses. Nor will any system of public reprisal for long-gone abuses give the needed remedy. Mr. Vail is cheering and confirms other hopeful signs: "There is evidence of better understanding and appreciation and more substantial justice on both sides." But, notwithstanding the better ethical state, there is disturbance and non-employment, and underlying these effects, antedating the European war, is the drastic anti-corporate attitude which has strongly marked government during three Presidential administrations. Only in the present administration has there come an admission that legislation is past, that the road is clear. It is not only what may be done but what has been done by regulation that interests investors. Those upon whom regulation has fallen as a thief in the night will not readily again risk money where heavy loss is imminent. To reduce non-employment, to start expenditure, to increase consumption, to restore the production which follows public service prosperity, Mr. Vail proposes a restoration of conditions which will inspire confidence in securities to command capital with which the needed vast expenditures can be begun.

Steam Auxiliary for Southern Plant

In this issue there is described a very carefully designed plant intended wholly as auxiliary to the hydroelectric system of the Southern Power Company. As our readers will remember, this company operates plants in North Carolina and South Carolina having an aggregate rating of over 100,000 hp and supplying energy to an area of more than 1500 square miles. The hydroelectric stations of the system have been equipped to supply primary power on the basis of the average flow for 355 days in the year, as nearly as this quantity can be determined. Therefore auxiliary equipment must be provided to supply this amount of primary power whatever the absolute minimum flow may chance to be. In point of fact the flow value ranges from 67 per cent to 80 per cent of the average, varying from plant to plant. To supply the possible deficit it was found necessary to provide auxiliaries of some 30,000 hp in rating. There are three plants, each of about 10,000-hp rating, one near each end of the system, and the new one here described at Mount Holly, N. C., about 11 miles from Charlotte, which is the chief center of the load. Each of the plants is conveniently situated for dealing with heavy local loads and can furnish power independently to the whole high-tension system, and each acts as a reserve for the others.

The Mount Holly station is situated on the Catawba River, where ample water for boilers and condensation can be obtained and where the railway facilities for delivery of fuel are excellent. Provision has been made for doubling the output rating when it becomes necessary. As is true in other stations of the system, the electrical apparatus has been designed for the ultimate operation of the system at 100,000 volts, although the transformers now raise the pressure to only 44,000 volts. The boiler plant is arranged for 175 lb. steam pressure and 100 deg. Fahr. super-temperature and is equipped, as a matter of course, with mechanical stokers. The mechanical arrangements for handling fuel are very complete, so that the only operation which has to be performed independently of the machinery is dumping the hopper-bottom railway cars and pushing the ash cars to the elevators. A plant of this sort must be held in readiness much of the time with banked fires, and its year's operation cannot show a high efficiency, although the operating efficiencies at full load are good, the guaranteed steam consumption at 85 per cent power-factor falling as low as 15.3 lb. of steam per kw-hr.

Perhaps the most interesting feature of the station is the provision for securing water. The source of supply is the Catawba River, which carries a great deal of silt. To take care of this condition there are two independent intake chambers fitted with coarse screens, of which either can be entirely shut off for cleaning. Thence the water passes either to the condenser, for which it need not be filtered, or to the pump reservoir through a filter. It is again filtered for boiler service from an overflow in the hot well, so that the feed water is well cleared of suspended matter. The filters are of coke and excelsior bedded on metal lath. For cleaning purposes the flow of the water can be reversed through the filters and the deposit cleared off with a pulsometer pump. These precautions have proved very effective in keeping up a proper water supply. The plant, which seems to be singularly well adapted to its use, is representative of the very simple and effective type of auxiliary plant necessary in connection with many hydroelectric systems.

A Study of Heat Insulation

An exceedingly practicable investigation of heat insulation for electric ovens, by Messrs. A. E. Kennelly, F. D. Everett and A. A. Prior, is recorded in this issue. It has special bearing on the development of electric cooking, in which proper heat insulation is of the utmost importance. The oven considered generally, whether used for baking armatures or pies, is usually extremely crude and of very low efficiency. Electric-oven heating, in which the heat is actually applied within the oven itself, ought to be, and is, highly efficient if the heat thus applied is conserved and not allowed to flow outward through the walls. The experiments made by the authors were directed at the efficacy of the walls in retaining the heat and hence raising the efficiency of the appliance. Use was made of an inclosure of asbestos board with the heating units inside, tests being made in succession with a single inclosure, with a double inclosure, with an air space, and with a double inclosure filled with supposedly heat-insulating material. The principal difficulty encountered in the investigation seems to have been the maintenance and measurement of the temperature inside the oven. It was found necessary to use an electric fan to distribute the heated air, and when this was done fairly constant results were obtained.

The practical data are given in terms of the watts required per degree centigrade difference of temperature maintained under steady conditions. With single walls the constant was approximately 40 watts per degree, and with double walls nearly 25 watts. Breaking up the space between the walls in the compartments produced no perceptible effect, probably for the reason that when steady conditions were reached with the double walls the temperature distribution was too uniform to allow enough circulation to be worth considering. Packing the space between the walls with cotton waste brought the watt constant down to a little over 16, and when this waste was replaced by a species of mineral wool the constant fell to between 12 and 13; that is, the mineral wool packing doubled the efficiency of the oven. It would be well worth while to supplement these tests with others involving different heat-insulating combinations in order that the heat losses might be still further reduced. Whatever may be said of the necessary losses of heat in electric appliances generally, they should be reduced to a minimum in ovens, and the best method for obtaining the maximum efficiency is of very practical value.

A New Scheme of Rates for Energy

Those of our readers who are interested in making a collection of schemes of charging for electricity will be both entertained and instructed by an article by Mr. Franklin Punga abstracted in the Digest. Of course, everyone is familiar with the ordinary combined schedule by which the customer pays at a certain flat rate based on demand or installation plus a meter rate adjusted on some convenient basis. Schedules of this kind are modifications of the general plan of a constant stand-by charge plus a service charge, and are in rather extensive use. They have in common the merit of taking cognizance of the demand made by the customer on the equipment of the station. In addition to such charge a sliding scale is usually provided for the energy metered. In whatever way the two factors in the price are combined, it is now universally recognized that they are so adjusted to each other as practically to charge what the traffic will bear, considering the place and kind of service.

The present proposal of Mr. Punga is interesting in that it involves in effect a combination of a flat rate with a duplex meter service, one rate applying as an added charge to peak demands and the other as a rebate to the valleys in the load. Use is made of an ingenious meter which records the hills and valleys; a suitable adjustment of the hill and valley prices will make a reasonable approximation to a fair charge for almost any kind of load anyone is likely to encounter. The plan in various modifications is evidently applicable to widely diverse conditions. It provides an interesting combination of a meter charge depending on the demand combined with a stand-by charge based on the general average. Although we have little faith in any of these complicated systems of rate making, particularly those requiring special instruments for their operation, yet this fact does not detract from our appreciation of the ingenuity displayed in this and similar schemes. We believe that very simple rates are of great advantage in securing the confidence of the customer in the good intentions of the company. The old two-rate meter, now suppressed in most places, was one of the most reasonable and promising of all the rate-making plans graduated to meet the nature of the load, and yet it fell into disrepute. Mr. Punga's scheme has its good points, and we commend it to the study of schedule makers. However, from the standpoint of American conditions its requirement of special metering apparatus is rather forbidding.

LETTERS TO THE EDITOR

Evaluating the Isolated Plant

To the Editor of the ELECTRICAL WORLD:

SIR:—In connection with your article "Evaluating the Isolated Plant," on March 13, 1915, it should be noted that motor-service solicitors leave no stone unturned to obtain every desirable load. However, in many cases isolated-plant owners are loth to regard as a part of their operating expense the fixed charges discussed by the solicitors other than the part due directly to the new electrically driven equipment. The subject of a fixed charge, however, is one of great importance and has at least a favorable bearing on the mind of the prospective customer, even though such charges be not considered by him as part of the operating cost.

If a company has insufficient capital and its borrowing capacity is limited, the interest on the investment may properly be charged at the determined profit which that company chooses to make on capital, but in the event of a company having sufficient capital and being able to borrow at the prevailing rate of interest, it would be rather difficult to get the management of such a company to figure in the costs a rate of interest equal to the percentage of profit.

It is not to be expected that, in figuring costs, a company will add the percentage of profit to the materials going into the product, electric energy being just as much of a raw material as cotton, wool, or whatever materials go into the finished product.

This argument would also be true if the company kept its accounts in such a manner that it could liquidate at any time, but most manufacturing concerns hope and expect to continue in business for a reasonable length of time—at least during the life of any isolated plant that might be installed. Five per cent interest and 8 per cent depreciation is all that a well-financed company may be expected to charge to the cost of operating motor-service equipment.

R. W. ROLLINS,
President and General Manager
Worcester Electric Light Company.

Worcester, Mass.

To the Editor of the ELECTRICAL WORLD:

SIR:—Your editorial "Evaluating the Isolated Plant" touches upon a subject to which surprisingly scant attention has been given, probably because of the failure until recently to analyze closely the elements which make up the cost per unit in factory production.

After much discouragement the salesman has been able to get the motor-service user as a rule to allow a charge against investment in the way of interest, depreciation, taxes, etc., but the "profit charge" is an equally legitimate expense which it has been difficult to persuade the prospective customer to take into consideration.

The central-station motor-service salesman has previously followed the line of least resistance and confined his efforts to the many cases where the cost of operation alone would show a comparison favorable to central-station operation.

In the last few years an intimate study of the cost of production has become absolutely necessary for the manufacturer. A better understanding of the effect of varying output (load-factor, as a central station man would state it) upon unit cost has brought the trained production engineer to recommendations as to investment to which previously little thought on the part of the manufacturer has been given.

Sparing investment in "fixed plant" is now the rule where the production engineer of experience is in charge, but an education along the lines of the value of investment in a private generating plant is greatly needed by the manufacturers of the country. A free discussion through your columns will be of great assistance to the motor-service salesmen.

If rates in the future are to be based upon the "value of service," it is highly important that the true value of the service be determined in each case.

H. H. HOLDING,
Industrial Power Engineer,
Public Service Electric Company.

Newark, N. J.

To the Editor of the ELECTRICAL WORLD:

SIR:—Where the competitive nature of central-station service is properly presented the element of interest is, of course, always present. The amount accepted by the consumer or his engineer depends upon his own and local operating conditions. Some, as in the instance of municipalities, will contend for rates as low as 4 per cent, while others are willing to admit 6 per cent and probably take into consideration the fact that if this portion of their capital is not tied up in a generating plant, but is utilized in connection with the consumer's undertakings, a somewhat higher percentage can be earned. Until very recently the contention of the engineers connected with the national government was that neither interest nor depreciation should be allowed, as the money necessary to install isolated plants was obtained through taxation. I believe the fallacy of this argument is now being recognized, and that the national government allows 3½ per cent as representing the interest element in isolated plant cost.

Depreciation, rather than interest, is the element usually overlooked. Knowingly or unknowingly, a great many engineers fall into the error of omitting depreciation altogether. When the item is brought to their attention they usually contend for the smallest possible percentage, oftentimes claiming a rate which would demand an impossibly high period of useful life. Oftentimes also depreciation may be computed at compound-interest rates, though no instance has been known to the writer in which this method of accounting is followed.

In their competitive cost estimates our most competent technical engineers seldom take into consideration the fact that depreciation of isolated plants is not physical alone, but rather that it is competitive. This element of competition is twofold: (a) through improvements by which old apparatus becomes relatively inefficient, and (b) the competitive cost of an outside service of an adequate nature.

A relatively low rate of physical depreciation—say one which allows from ten years' to fifteen years' life of the plant—is probably correct. Under local conditions this may be modified one way or the other. But depreciation through the availability of improved and more efficient apparatus should be based upon a higher rate, and that through the competition of central stations still higher. Thus, in a single year the latter element might come into full play. The estimated cost of operating a private plant might be fairly competitive with the corresponding costs of outside supply in one year, and yet in the next year, through reductions in this cost by which equal service can be obtained with less expenditure, the useful life of the plant is ended, and in this instance, of which many examples could be cited, the annual rate of depreciation is substantially

100 per cent, less, of course, such salvage value as the plant may have.

Instances are not rare where private plants have been installed through mistakes or misrepresentations on the part of expert engineers and have been removed within one, two or three years. Thus, in these instances the rate of depreciation becomes substantially 100 per cent, 50 per cent or 33 per cent, less, as indicated, the salvage value of the plant. Reductions in the wholesale-service rates of competing central stations perhaps form a better indication of the probabilities of the useful life of the private plant in the competitive sense than any other available means. Where all of these elements are taken into consideration, it would seem that a very much higher rate of depreciation should be accepted than that which is indicated either by physical life or the element of improvement in the efficiency of the generating apparatus.

Perhaps the most serious omission in estimating private plant costs in important buildings is that which relates to the cost of preparing the structure for the power plant. Thus, in a recent instance a great deal of excavation was required in live rock, which in turn had to be met in costly building construction, including additional steel. Where an additional basement or sub-basement is required the construction cost is very much higher than the average of the building as a whole, and yet in no instance apparently has this ever been considered in determining either the rental value of the space occupied by the plant or the expenditure necessary to provide this space, including various elements of cost, such as interest, depreciation, maintenance and taxes. Taxation is also usually omitted, and yet in the valuation of every large building probably a large relative item is allowed by the tax authorities covering the cost of the power plant.

New York, N. Y. ARTHUR WILLIAMS.

Static Electricity from Transmission Lines

To the Editor of the ELECTRICAL WORLD:

SIR:—In the ELECTRICAL WORLD of Jan. 9 reference is made in the Digest to the use of inductive reactance connected on lines to ground for bleeding off the accumulation of static electricity.

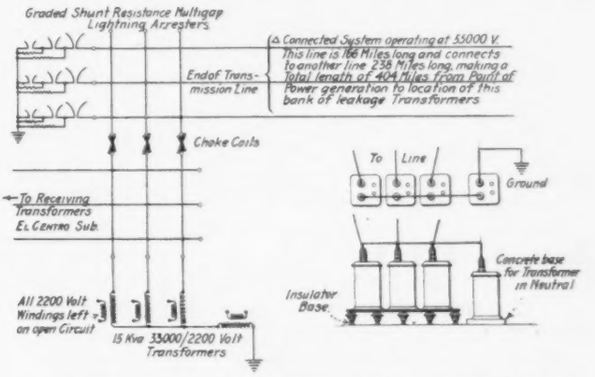
Several months ago, and before I knew anything of this practice, we had a very bad case of static on a 55,000-volt transmission line that we constructed in connection with the Coachella Valley Ice & Electric Company in the Imperial Valley. This line was built on wooden poles, the conductor being of 3/0 seven-strand aluminum. We used No. 351 Locke insulators, the wires being spaced on an equilateral triangle, 72-in. centers, and the length of the line being 166 miles.

We connected this 55,000-volt line at the terminus of a 238-mile transmission system from Inyo County—connection being made at San Bernardino substation, this making a total transmission system from our power house at Bishop, Cal., of 404 miles.

The Imperial Valley line is operated delta at 55,000 volts. Shortly after the system was put into operation trouble was experienced by two or three of the pole tops burning off and causing short-circuits on the system. I made a trip over the line at night in the Imperial Valley and found a great number of insulators leaking static badly, which resulted in charring the pole and cross-arms, and I realized that something must be done at once to relieve the condition. I conceived the idea of bleeding the static off to ground, and recommended that the Holten Power Company, at El Centro, the end of the line, install four 15-kw transformers we had in stock and connect them directly between the line and ground.

These 15-kw transformers were wound on the primary side for 33,000 volts and on the secondary side for 2200 volts. Three of these transformers were connected in star on insulated platforms and the fourth transformer was connected between the star of the three transformers and ground on the primary side, the secondary 2200-volt windings being left open. The object of using the fourth transformer was to protect the 33,000-volt circuit from over-voltage in the event of ground appearing on the 55,000-volt circuit.

The effect of this insulation was immediately to overcome all the difficulty with the leaking static, and the


Graded Shunt Resistance Multigap Lightning Arresters
End of Transmission Line
Δ Connected System operating at 55000 V.
This line is 166 Miles long and connects to another line 238 Miles long, making a Total length of 404 Miles from Point of Power generation to location of this bank of leakage Transformers
Choke Coils
To Receiving Transformers El Centro Sub.
All 2200 Volt Windings left on open Circuit
15 Kva 33000/2200 Volt Transformers
To Line
Ground
Concrete base for Transformer in Neutral
Insulator Base

ARRANGEMENT OF BLEEDING TRANSFORMERS

line now is as quiet and free from static as could be desired. The sketch herewith shows the arrangement of these bleeding transformers as connected to the system.

C. O. POOLE.
Chief Engineer Southern Sierra Power Company.

Riverside, Cal.

Opportunities for Manufacturers in Russia

To the Editor of the ELECTRICAL WORLD:

SIR:—Permit me to say a few words about the keynote to the situation of electrical manufacturers in Russia, to supplement Mr. Chester W. Purington's article, "Opportunities for Electrical Manufacturers in Siberia," in the ELECTRICAL WORLD, Jan. 2, page 267. I consider myself competent to speak on the subject because I was born in Russia, and only seven years have passed since I left that country.

The opportunities for electrical trade are great in Russia, but it is not a simple matter to secure and develop the trade. The most densely populated parts of Russia, starting from the Gulf of Finland, are the cities of Revel, Riga, Windau, Libau and Mittau. Most of the people are of German and Scandinavian descent and prefer to talk German rather than Russian. The people living between Mittau and Warsaw are of Lithuanian and Polish descent, and do not like to talk Russian at all, because they hate Russians and the Russian language, so that one must use German if he wishes to transact business with them.

Most of the apparatus in service is operated at 110 volts or 220 volts direct current, except the street railways, which are 500-volt systems. A small part of the apparatus is of English make. American goods are considered superior, but the people know very little about them.

For American manufacturers wishing to open offices for consulting engineering or sales work in Russia the best location is Riga or Petrograd. The office should be put in charge of a Russian-American who is familiar with Russia and her people and with American advertising.

J. G. KOPPEL,
Electrical Engineer Sault Ste. Marie Bridge Company.

Sault Ste. Marie, Mich.

Auxiliary Station for Transmission System

Turbine of Mount Holly Steam Station of the Southern Power Company Operates as Synchronous Motor When Not Under Load

BY CURTIS A. MEES

THE Southern Power Company of Charlotte, N. C., now operates five hydroelectric plants—the Catawba station, rated at 10,000 hp; the Great Falls station, 32,000 hp; the Rocky Creek station, 32,000 hp; the Ninety-Nine Islands station, 24,000 hp, and the Saluda station, rated at 3500 hp—the aggregate rating representing 101,500 hp.

Transmission over an area approximately 65 miles by 240 miles necessitates sectionalizing of the system in case of storm or accident, and the auxiliary stations serve a twofold purpose in that they produce, with comparatively insignificant transmission, an appreciable amount of power in the centers of maximum public service demand, readily available in case of accident or atmospheric disturbance, while they are also required to supplement the outputs of the water-power plants during the periods of low water so as to bring the outputs up to the 355-day average.

All stations of the Southern Power Company are rated for the sale of primary power on the average flow for 355 days in the year as determined from all discharge records. The absolute minimum flow is found to be only from 67 per cent to 80 per cent of the 355-day flow, depending on the altitude of the power plant. Thus, for the Great Falls and Rocky Creek stations the minimum is 67 per cent of the 355-day average, while for the Catawba station further up the river it is only 75 per cent. For the Ninety-Nine Islands station on the Broad River the minimum is 75 per cent, and for the Lookout Shoals station now being built above the Catawba station the minimum is only 85 per cent.

On this basis there were required for the present hydroelectric system 30,000 hp in auxiliary steam equipment, and when Lookout Shoals station is placed in commission an additional 3600 hp will be required.

In this connection it is significant that storage is not considered beyond that necessary to conserve the night flow by concentration of practically the entire flow into a ten-hour discharge. The rivers now utilized carry such volumes of silt that real storage is impracticable.

For the reasons above cited the necessary steam auxiliary equipment was divided into three units, each one close to one of the three important distribution centers. The steam stations at Greenville, S. C., and Greensboro, N. C., being near the ends of the system—the most exposed points—were built first, each of 10,000-hp rating. These plants are almost identical in design and equipment, both of which were governed by the desire to secure a simple layout of the lowest first cost.

The third plant, also of 10,000-hp rating, was recently completed at Mount Holly, N. C., on the Catawba River, about 11 miles from Charlotte. This plant was designed and equipped to secure the lowest possible operating costs. Selection of the site was based on meeting the demand for emergency service in the vicinity of Charlotte, the most important public service center, and on the availability of water for condensing purposes. The property is on the line of the Piedmont Traction Company, an affiliated organization. The layout was made to permit extension of the railroad tracks over the top of storage bunkers so that all possible labor, manual or mechanical, might be eliminated in the handling of fuel. The present installation of 10,000 hp will, it is expected, be doubled in the near future, and such extension has been anticipated in the present layout.

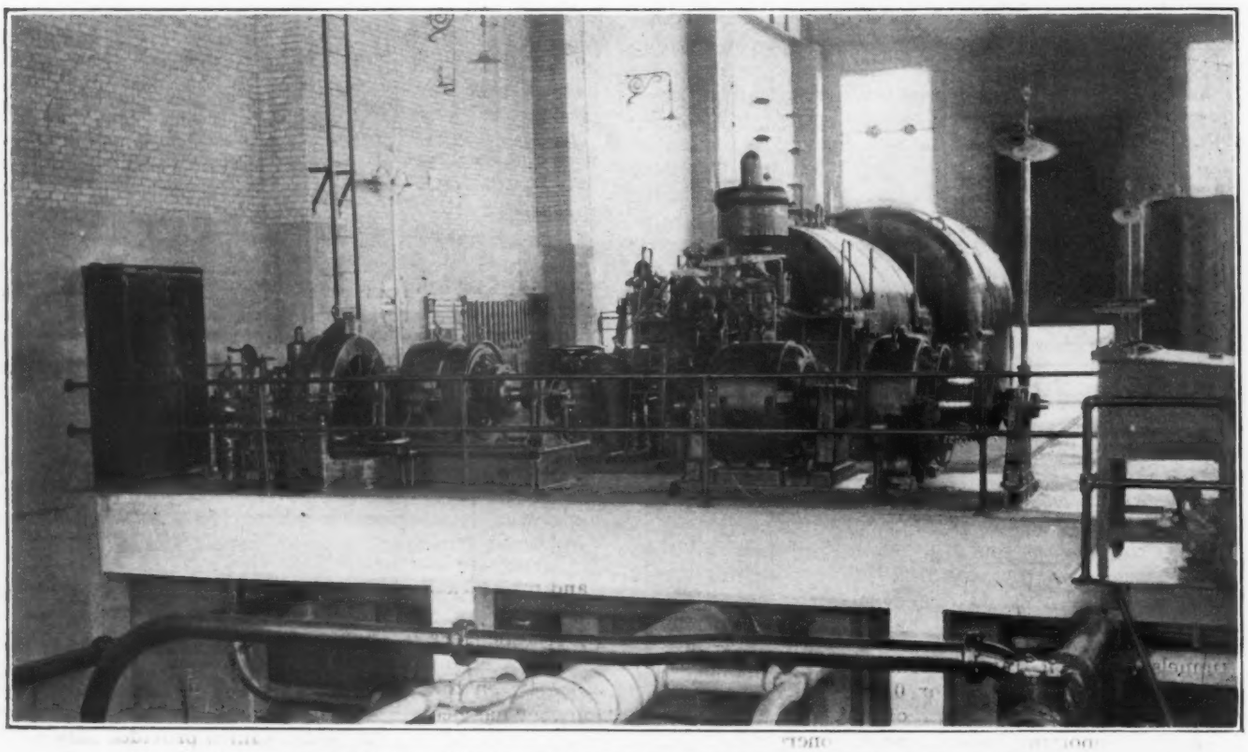


FIG. 1—GENERATOR ROOM OF MOUNT HOLLY STEAM STATION OF SOUTHERN POWER COMPANY

The selection of the building site, though ideal in all other respects, was an unfortunate one in regard to foundation. Extensive borings made with a test auger showed soft rock foundation at an average depth of about 18 ft., and these borings were verified in open pits. The foundation tests showed a permissible loading of 4 tons per sq. ft., on which basis the design was carried out. Upon excavation, however, it was found that the layer of soft rock was in many places only from 2 ft. to 4 ft. through, and underneath quicksand was found from 6 in. to 18 in. deep on a clay bed. The entire structure was therefore redesigned for a maximum loading of 1.5 tons per sq, ft.

Because of the great cost thus involved the entire method of foundation construction was changed. The outer walls were designed with adequately spread footings, the bases of the tunnels and sumps were heavily reinforced to act as pads, and the equipment loads were then transferred to these pads and outer walls. All boilers and bunker columns are supported on reinforced concrete beams.

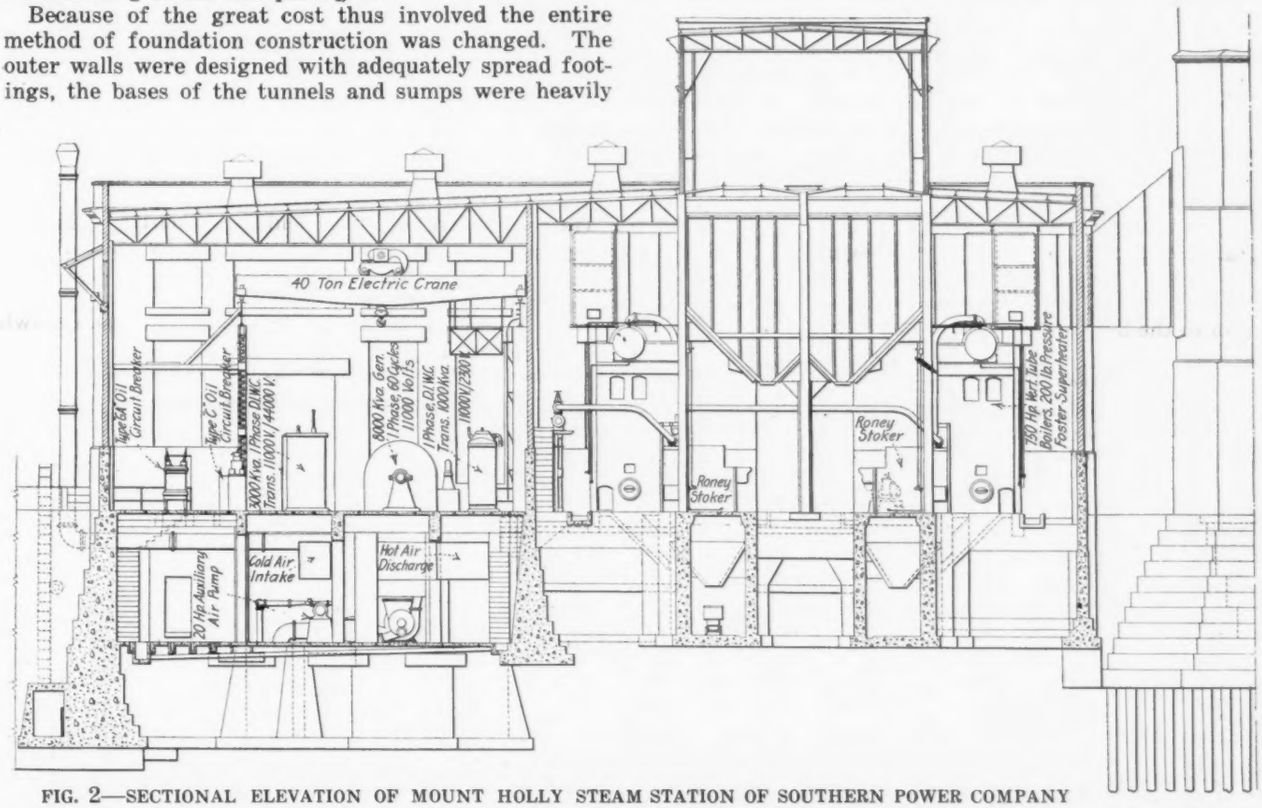

40 Ton Electric Crane
Type 6A Oil Circuit Breaker
Type C Oil Circuit Breaker
3000 Kva. 1 Phase O.W.C. Trans. 11000 V./44000 V.
6000 Kva. Gen. 1 Phase, 60 Cycles 11000 Volts
1 Phase O.W.C. Trans. 1000 Kva. 11000 V./2300
Roney Stoker
Roney Stoker
750 Hp Vert. Tube Boilers, 200 lb. Pressure Foster Superheater
Hot Air Discharge
Cold Air Intake
20 Hp Auxiliary Air Pump

FIG. 2—SECTIONAL ELEVATION OF MOUNT HOLLY STEAM STATION OF SOUTHERN POWER COMPANY

Because of flood the floor of the station was elevated from 4 to 5 ft. above the ground surface, and in the boiler room the spaces between beams were filled in with earth after the boilers had been partially erected. For the present installation the building is roughly 126 ft. 8 in. long by 127 ft. 3 in. wide, divided by a partition wall into the boiler room, 71 ft. 3 in. wide, and the engine room, 55 ft. 3 in. wide.

The engine room has two floors over part of its area and provides 12,400 sq. ft. of floor space, which, with the necessary addition for doubling the output of the station, will eventually be increased to 19,900 sq. ft. or 1.24 sq. ft. per kva turbine rating. It must be borne in mind that this equipment includes all electrical apparatus with provision for ultimate operation at 100,000 volts.

The boiler room for the present installation contains about 8950 sq. ft. of floor space, exclusive of the ash tunnels, and will, for the complete installation, be increased to 13,900 sq. ft., or 0.87 sq. ft. per kva. The building is practically fireproof.

A self-supporting steel frame on concrete foundations is closed in with curtain walls and pilasters built of a U-shaped concrete brick which forms virtually a hollow wall. All rack and frames are steel, and steel rolling doors or shutters are used. Floors and basement columns are built of reinforced concrete in which Kahn bars were used for footings and Corbar units for beams. The roofing is of flat reinforced plates laid on steel purlins and covered with prepared asphalt roofing. Sixteen 24-in. ventilators are provided. The car shed is of corrugated iron supported on a structural-steel frame.

The bunkers, of which there will eventually be three, have a capacity of 800 tons each. They are built of plate steel, butt-jointed, with cover plates and stiffeners on the outside. They are supported partly by suspension from the track girders, partly from below by girders and cantilevered beams on columns. For protection of the steel-plate work against wear, corrosion and heat a removable lining was placed on the inclined faces. This consists of ferroinclave laid over hardwood strips and plastered on the exposed face with concrete. There is, therefore, no iron-to-iron contact, and the air space provided tends to minimize bad effects of bunker fires. The cost of these bunkers was about $12.50 per ton capacity, or 30 cents per cu. ft. Only nut and slack size coal is used, and the bunkers are spouted directly to the stoker hoppers with spreader spouts and undercut gates.

The ash hoppers were similarly designed with a lining. The stiffeners were placed on the inside and support hook tiles, which happened to be on hand. The tiles were then covered with adamant concrete lining. Undercut gates are used in these hoppers.

Ashes are dumped from the hoppers directly into cars and may either be disposed for grading on the property or loaded on cars by means of a bucket elevator. A hydraulic elevator is used to lift the cars from the tunnel to the surface.

Between the beams on which the boilers rest a soot hopper has been formed by concrete lining in excavation, and a door leading to the ash tunnel provides easy means for cleaning.

The only handling of fuel, therefore, consists in dumping hopper-bottom railroad cars and pushing the ash cars to the elevators.

A somewhat novel feature is the arrangement for securing water. The Catawba River contains no injurious chemical matter, but it does contain a great deal of silt, especially during flood periods. While good enough for condensing purposes, it is not suitable for the boilers. The intake is arranged with two chambers equipped with coarse screens. A sluice gate closes the intake completely, and this inlet is protected by a coarse rack spaced 1 in. between grids. Either screen chamber may be closed off by pivoted gates and cleaned without interfering with operation.

From the intake tunnel the water passes by gravity, in proportion to quantities used, either through a filter and into the tank pump reservoir or to the condenser. From an overflow in the hot well the water passes through the hot filter to the transfer pumps. The filtering medium consists merely of a coke and excelsior bed on ribbed metal lath. For cleaning the filters the water current is reversed and the agitated water is pumped off with a pulsometer. These filters have proved very successful.

The chimney, 230 ft. high, 14 ft. inside diameter at top, built by the Alphons-Custodis Company, was founded on piles supporting a mat reinforced with old rails. The foundation base was left hollow to secure minimum loading.

The conditions under which the plant is operated are such as to make impossible apparent economical energy production. The entire plant is kept under banked fires the greater part of the time, always ready for emergency service. In case of trouble full load, or even maximum overload, may be called for, and frequently the demand is for very short periods only. While the fires are banked the turbine is operated as a synchronous motor to improve the power-factor on the entire transmission system, which carries a large inductive load.

Under these circumstances it is particularly easy to respond to sudden load demands because the unit is already up to speed and in synchronism, the turbine is kept warmed up, and only a change in the field excitation is necessary to place the unit on the line. This takes only a few minutes at most.

The station equipment consists of a 6800-kw condensing turbine and a 4500-hp boiler plant, with all necessary equipment, more particularly dscribed as follows: One 6800-kw Westinghouse-Parsons double-flow steam turbine, 175 lb. pressure, 1800 r.p.m., directly connected to a 8000-kva revolving-field three-phase, 11,000-volt, sixty-cycle generator and equipped with a Westinghouse-Leblanc jet condenser provided with a 300-kw non-condensing steam-turbine-operated circulation pump; one 20-kw, 220-volt motor-operated Leblanc air pump; one 100-kw non-condensing steam turbine directly connected to a 100-kw, 250-volt, 2400-r.p.m. direct-current generator, mounted on a common bedplate; one motor-generator exciter set, 150-hp, 2200-volt, three-phase, sixty-cycle motor, 100-kw, 250-volt, 1200-r.p.m. generator, and a complete panel-type switchboard for the above.

Ventilation for the main generator is provided by a plate-steel duct, 4 ft. 5 in. by 5 ft. on the intake and 5 ft. by 6 ft. 4 in. on the discharge, providing 32,000 cu. ft. per minute at a velocity of about 24 ft. per second. Inlet and outlets of this duct are in screened wells outside of the building.

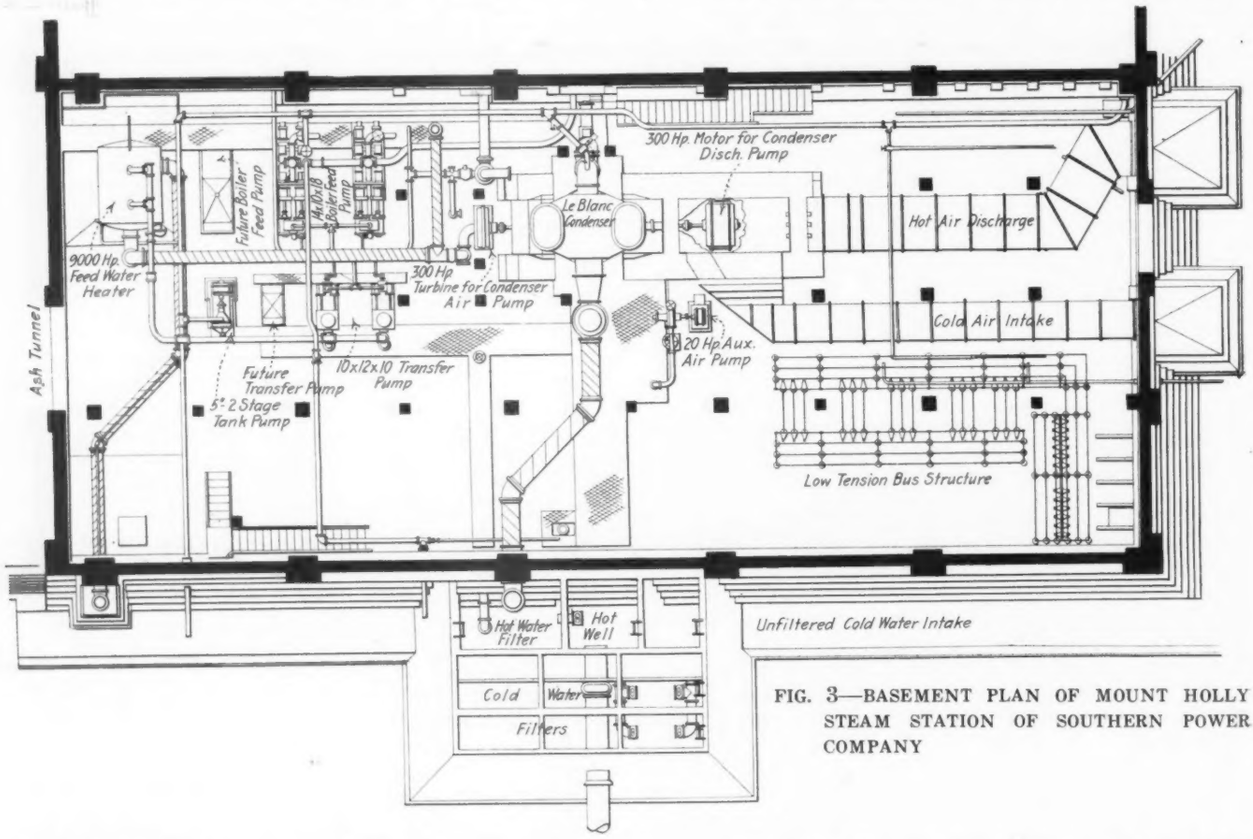


FIG. 3—BASEMENT PLAN OF MOUNT HOLLY STEAM STATION OF SOUTHERN POWER COMPANY

The following specification excerpts may be of interest:

Generator Efficiency at 85 Per Cent Power-Factor, Room Temperature 25 Deg. C.—Half load, 92 per cent; three-quarters load, 94 per cent; full load, 95 per cent; one and one-quarter load, 96.25 per cent; one and one-half load, 96.5 per cent.

Temperature Rise in Degrees Centigrade for Both Armature and Field.—Full load, twenty-four hours, 40 deg.; one and one-quarter load, twenty-four hours, 50 deg.; one and one-half load, one hour, 60 deg.

For 175-lb. steam pressure at the throttle, 100 deg. Fahr. superheat and 28-in. vacuum, the normal rating of the steam turbine is 10,200 brake-hp, with a maximum continuous rating of 12,750 brake-hp.

For the above generator at 85 per cent power-factor the following steam consumption was guaranteed:

Load in Kw	Lb. Steam per Kw
3400	16.7
6800	14.9
8500	15.3

For 6,000,000 lb. injection water per hour (26.7 cu. ft.-seconds), at 80 deg. Fahr., and 102,200 lb. condensed steam per hour, a vacuum of 28 in. shall be maintained.

The condenser air pump shall be of sufficient rating for maintaining a vacuum in the turbine shell, with steam and exhaust valves closed, such that the unit may be operated as a synchronous condenser, the steam end being driven by the alternating-current generator operating as a synchronous motor.

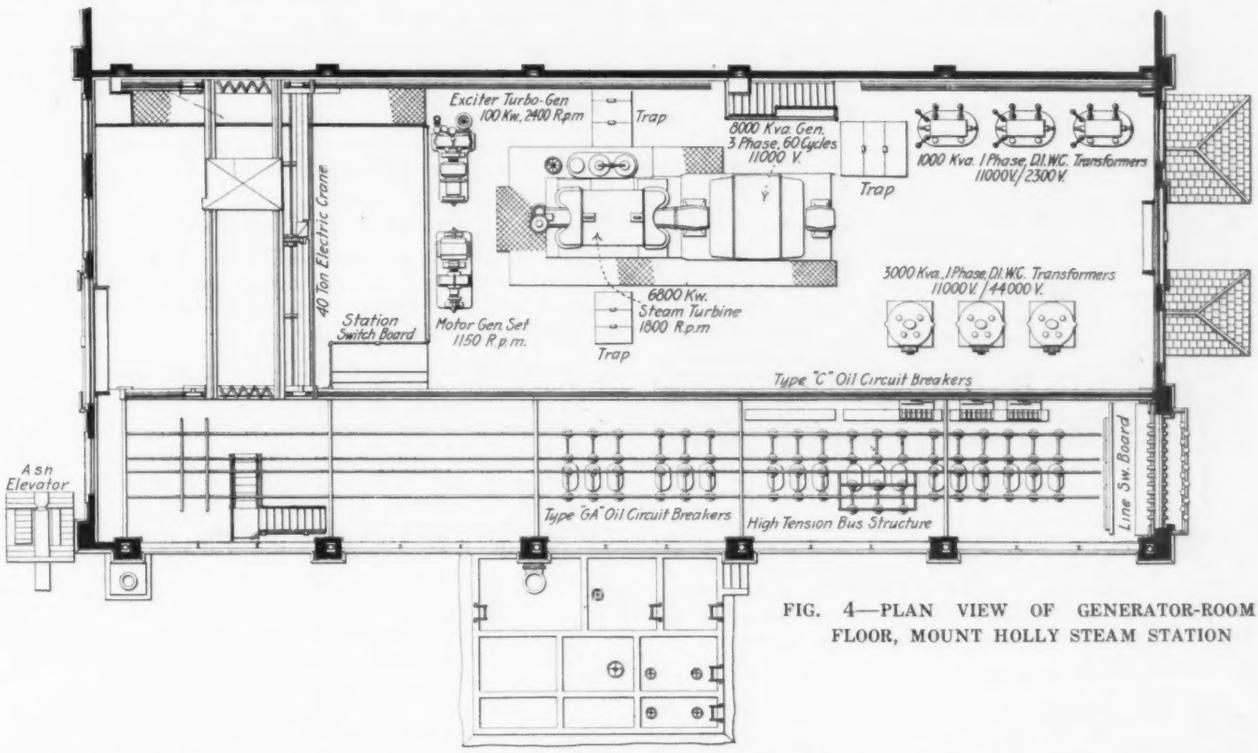


FIG. 4—PLAN VIEW OF GENERATOR-ROOM FLOOR, MOUNT HOLLY STEAM STATION

MOUNT HOLLY STEAM STATION—AREAS AND VOLUMES PER RATED CAPACITY

	8000 Kva		16,000 Kva	
	Sq. Ft.	Cu. Ft.	Sq. Ft.	Cu. Ft.
Engine room proper	1.55	48.77	1.245	37.99
Boiler room—total without intake	1.60	50.18	1.28	38.83
Boiler room—including ash tunnel and coal storage	1.40	50.80	1.08	39.34
Boiler room—total	2.07	63.29	1.56	48.57
Building proper—including coal storage	2.95	99.58	2.33	77.33
Total plant—without intake	3.67	113.43	2.84	87.40
Coal storage	....	8.4	....	6.2
4500 boiler-hp:				
Boiler room proper	2.49	90.32	....	....
6800 kw:				
Building proper	3.47	117.15	....	....

Note.—Present plant, 8000 kva; 67,000 cu. ft. coal storage. Extended plant 16,000 kva; 100,500 cu. ft. coal storage.

Boiler Equipment

The boiler equipment comprises six 750-hp Erie City Iron Works vertical-tube boilers of the Dutch-oven type, set in steel casing, equipped with Foster superheaters, and 12 Roney stokers operated by two 5-hp engines with shafts provided for future motor connections.

In these boilers McLeod & Henry steel-mixture firebricks were used for the arches and refractories, and Franklin Crown No. 1 firebrick for walls exposed to high-temperature gases. The effective heating surface of each boiler is 6016 sq. ft.

The following boiler specification items may be noted:

Basis 1 hp = 30 lb. water evaporated per hour from 100 deg. Fahr., or 34½ lb. from and at 212 deg. Fahr. to steam at 70 lb. pressure.

Rating of each boiler, 1125 hp for coal of 14,250 lb.-Fahr. heat-units.

Per pound of such coal not containing more than 7½ per cent of ash when operating at 750 hp, 10½ lb. of water will be evaporated from and at 212 deg. Fahr. When operating at 1125 hp, 10 lb. of water will be evaporated from and at 212 deg. Fahr. per lb. of coal. The flue-gas temperatures will not exceed 650 deg. Fahr. The steam at the boiler outlet will not contain more than 1 per cent of moisture at or between the above ratings.

The following superheater performance is specified:

The temperature of 22,500 lb. of steam per hour at 160 lb. pressure, and containing not more than 1 per cent moisture, will be raised to 470 deg. Fahr., corresponding to 100 deg. superheat. When the boilers are evaporating 27,000 lb. of steam the superheaters will add from 90 deg. to 110 deg. for steam containing not more than 1 per cent of entrained moisture.

Stoker specifications are as follows:

For boilers rated at 10 sq. ft. of effective heating surface per boiler hp the following evaporation of water from and at 212 deg. Fahr. is guaranteed per pound of dry coal for the stated draft of water in the furnace of each stoker:

Draft, In.	Load, Per Cent of Full Rated Capacity	Water Evaporated Lb.
3/8	100	10.2
1/2	150	9.8
6/10	175	9.3
5/8	200	8.6

Pump Equipment

The present equipment of pumps is such that for the eventual duplication of the engine equipment only one more pump need be added to each of the sets of two now used. The intake and aqueduct are now of sufficient size for future doubled capacity.

Piping

All pipes through walls or floors pass through cast-iron sleeves, provided where necessary with bell ends to permit of yarn calking. All low-pressure piping was

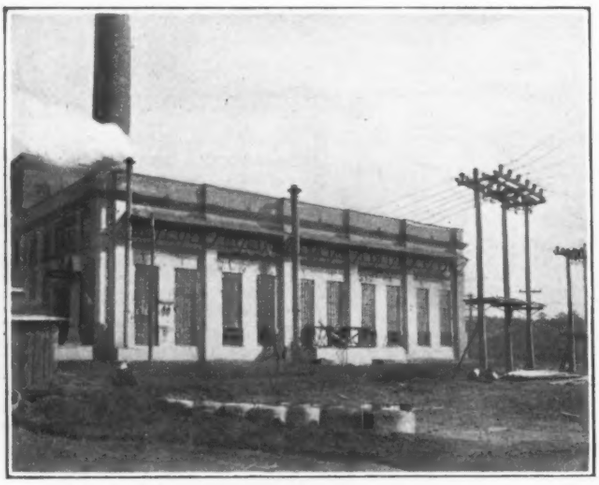


FIG. 5—OUTGOING LINES

tested to 100 lb. and high-pressure piping to 300 lb. per sq. in. All piping is identified by colors.

Filtered water is collected in a reservoir controlled by an automatic float valve. Pressure lines from the tank are carried into the bunkers and the ash pits.

Electrical-Transmission Equipment

The electrical equipment consists of a bank of three 3000-kva, 11,000/44,000-volt Westinghouse transformers of the water-cooled type, and a bank of three 1000-kva, 11,000/2300-volt General Electric water-cooled transformers. Westinghouse electrically operated circuit-breakers are used on the low-tension and high-tension sides of the transformers. The line openings consist of plate glass with a 2-in. hole mounted in wood frames.

A 40-ton Niles electric crane is installed, as well as a fairly complete machine shop for repair work.

The following percentages of the total cost were computed:

Item	Per Cent
Well, tank and hydrant line	0.72
Intake and tunnel	2.03
Coal bunkers, complete	4.78
Ash hoppers, elevators, tracks and soot chambers	0.88
Chimney	4.31
Boilers, smoke flue and feed-water regulators	17.55
Steam-turbine set, condenser and air ducts	22.03
Electrical equipment for power transmission	8.91
Piping and valves	5.62
Pumps	1.70
Feed-water heater	0.55
Electrical crane	1.15
Shop equipment—tools, furniture, etc	1.15
Drying out and starting	0.48
Building, including station lighting, filters, conduit, plumbing, engine foundations, trains, grading, etc	28.14

The record run on the plant to date is 9200 kw for a period of 120 hours. As soon as operating conditions permit, a thorough test will be made to determine costs of production and efficiencies.

Improvements Suggested by Experience

From experience gained under operating conditions the following improvements might be suggested:

Vents should be provided directly over the blow-offs.

One large tight damper should be placed in the smoke flue near the chimney for reducing the draft to a minimum while running under banked fires.

One storage bunker of similar design to those built might be used to advantage for storing coal for banking, and possibly a lorry might be used for distribution.

The electrical equipment would be better separated entirely from the engine-room equipment, and outdoor equipment would be more economical.

It would be more economical to operate the condenser circulating pump by motor rather than by steam turbine.

The table printed on page 777 sets forth the economy of the layout.

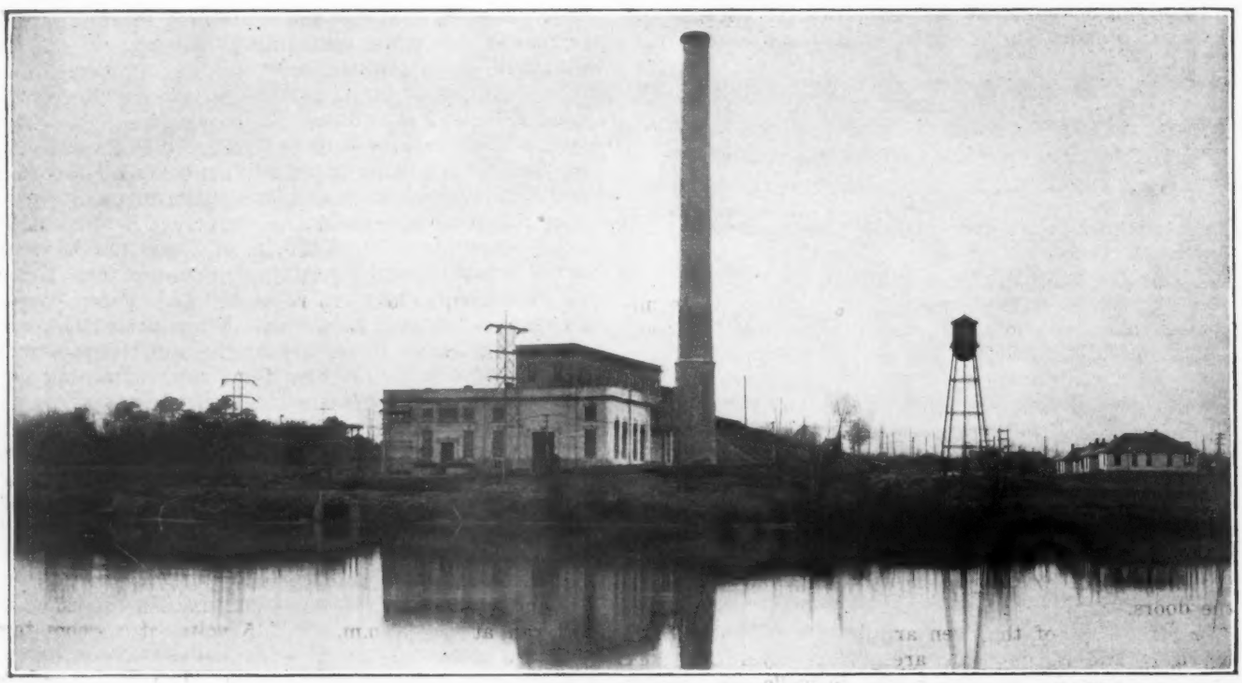


FIG. 6—MOUNT HOLLY STEAM STATION OF SOUTHERN POWER COMPANY

Thermal-Insulation Tests of Electric Ovens

Experimental Investigation of the Resistance to Heat Offered by Five Different Kinds of Oven Wall

BY A. E. KENNELLY, F. D. EVERETT AND A. A. PRIOR

AN extensive literature already exists on the subject of the thermal resistivity of heat-insulating materials surrounding hot pipes, ovens and similar apparatus. Nevertheless, it is believed that some measurements made by the authors on the thermal resistance of electric-oven hollow walls, containing air and other materials, will be of interest to makers and users of such devices.

The object of the research was to find the effect of placing different materials inside the hollow walls of an electric oven on the thermal leakance of those walls at or near the steady thermal state. Is it better, from a heat-insulation standpoint, to use hollow oven walls containing air only, or to fill them with solid heat-insulating substances? How much difference in loss of heat and electric power will there be in the two cases?

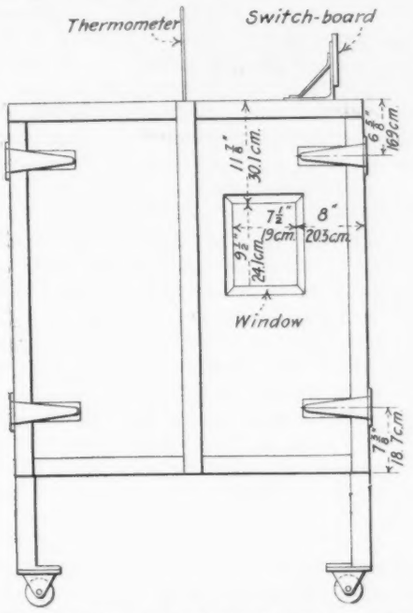


FIG. 1—FRONT VIEW OF ELECTRIC OVEN

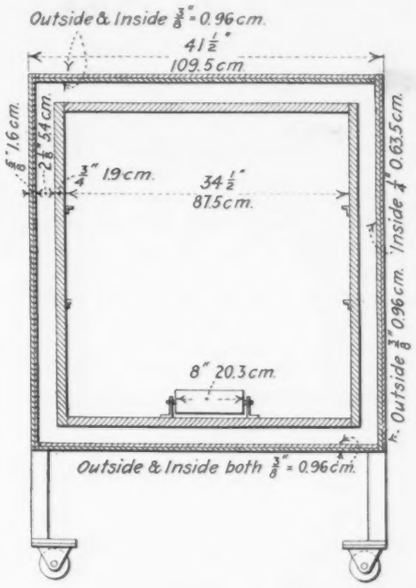


FIG. 2—CROSS-SECTION OF ELECTRIC OVEN

The Oven Experimented With

The electric oven was one constructed for heating and drying insulating materials in the electrical engineering department of Harvard University in 1912. It is of rectangular form and supported on four legs, terminating in rollers, so as to stand well above the floor. The front view cross-section and longitudinal section of the oven are presented in Figs. 1, 2 and 3 respectively. The principal dimensions are given in Table I.

At one end of the oven the walls are split and hinged vertically so as to form pairs of doors. Both the inside and the outside doors overlap, so as to form close covers. A glass window, 19 cm by 24 cm, is fastened into each pair of doors, and these two windows are set one behind the other, so that illuminated objects inside the oven can be kept visible from the outside without opening the doors.

All the walls of the oven are composed of "asbestos board." The inside walls are of one layer of ½-in. (1.27-cm) board. All of the outside walls are (except the top) of two layers of the board—the inner ¼ in. (0.64 cm) thick and the outer ⅜ in. (0.95 cm) thick. The top outside wall is of two layers each ⅜ in. (0.95 cm). The joints between slabs were calked with 85 per cent magnesia compound, and where a double layer of boards exists, as in all the outside walls, the layers are staggered to avoid coincidence of joints. Doors and windows are flanged with metal to insure good closure.

Heating System

The heating of the oven is effected by means of six coils of bare "Ia-Ia" zero-coefficient resistance wire, each wound specially on a horizontal porcelain cylinder. These heating cylinders are supported on the floor of the oven, as shown in Figs. 2 and 3. Each cylinder is 20.3 cm (8 in.) long and 6 cm (2 7/16 in.) in diameter. The resistance of the wire on each cylinder is about 12 ohms, so that heat is developed in each at the rate of approximately 1 kw when connected to direct-current 110-volt mains. By means of switches mounted on the outside of the oven the heater can be either disconnected or connected in various series-parallel groups, so as to regulate the heating up to a maximum of 6 kw. As a rule, all the heaters were connected in parallel, so as to obtain a floor distribution of generated heat as nearly uniform as possible, the voltage at heater mains being controlled externally.

In preliminary tests the distribution of final temperatures within the oven was found to be very un-uniform. As might easily be imagined, the air inside was much hotter at the top than at the bottom of the oven. In order to secure a more nearly uniform thermal distribution, it was necessary to employ a direct-current electric fan inside the oven operated from auxiliary mains. The fan and motor finally selected consumed about 50 watts and ran at 1710 r.p.m., on 115 volts, at a room temperature of 21 deg. C. The fan had a diameter of 30.5 cm (12 in.) and had four blades. The oven temperature had to be limited to such as would not dangerously

overheat the fan motor. The power absorbed by the motor was included in the heat input. The electric connections of the fan and the heating circuit are indicated in Fig. 4. The power absorbed by the fan motor was indicated on a separate wattmeter at 115 volts. At the working oven temperatures the power it absorbed diminished slightly. With the aid of this fan the temperature distribution within the oven could be kept nearly uniform, but without the fan it is doubtful if

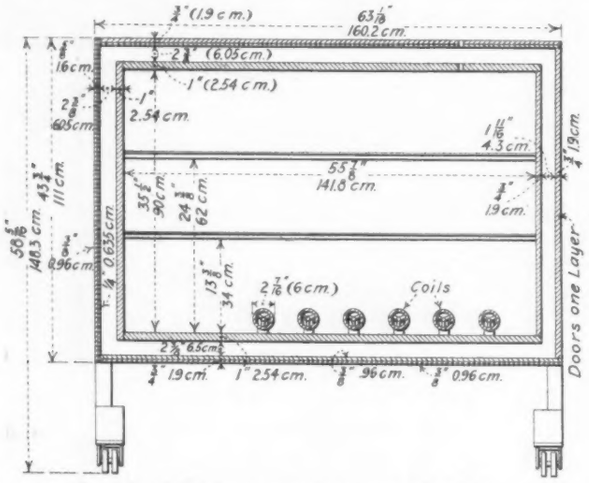


FIG. 3—LONGITUDINAL SECTION OF ELECTRIC OVEN

any reliable thermometric averages could have been obtained for the mean internal temperature. The wattmeters used were calibrated against standards, and their readings were corrected accordingly.

Centigrade thermometers were used with scales readable to one-tenth of a degree. At first four thermometers were employed, one inserted through a sheet-iron tube, so as to have its bulb in the air at the top of the oven inclosure; one laid on the floor at the bottom; the third suspended inside near the top, and the fourth suspended inside half-way up. The internal thermometers were read by the light of a heating lamp within the oven,

TABLE I—AVERAGE DIMENSIONS OF OVEN

	Length		Breadth		Height	
	Cm	In.	Cm	In.	Cm	In.
Oven external	160.2	63 1/16	105.5	41 1/2	111	43 3/4
Oven internal	141.8	55 7/8	87.5	34 1/2	90.1	35 1/2

	Outside Slab		Inner Slab	
	Cm	In.	Cm	In.
Side walls	1.60	5/8	1.9	3/4
Top and bottom walls	0.96	3/8	2.5	1.0
Distance between side walls	5.40	2 1/8	.....	.....
Distance between walls at top and bottom	6.05	2 3/8	.....	.....
Height of base from floor	37.30	14 1/2	.....	.....

through the double-glass window. These thermometers were found to read too high, owing to direct radiation from the lamp. A paper cylindrical petticoat shield applied to the bulbs, so as to screen off the light without interfering with the circulation of air, overcame this difficulty. Then the thermometer inserted through the sheet-iron tube in the top was found to read too low, owing to conductive escape of heat along the tube. The tube was therefore removed and replaced by a pair of corks, one in the outer and the other in the inner wall. The thermometer then gave satisfactory indications. With the circulating fan working, all of the four thermometers were found to coincide in their readings within 0.25 deg. C., so that only two thermometers were found to be necessary—the top one projecting through the corks and an extra one inside as a check. These were calibrated from standards in the physics department.

Procedure in Measuring Temperature Elevations

It is well known that if an electric oven starts cool, with all its parts inside and out at ordinary room temperature, the first effect of applying constant heating power within it will be to raise the internal temperature at a relatively rapid rate, this rate of rise gradually diminishing until, after an indefinitely great lapse of time, the internal temperature should cease to rise and the temperature elevation should reach a steady maximum value. The heat supplied to the oven is then entirely expended in leakage through the walls, and no longer raises the temperature. Consequently, in order to measure the leakage of heat with precision, it would be necessary to keep the power applied to the oven until the internal temperature was stationary. For an oven of the size here considered this would mean keeping on the heat for many hours together, a condition different from that ordinarily encountered in practice, besides entailing much difficulty and delay in arriving at results. It was therefore decided to make the measurements of thermal leakage after about eight hours of heat application. In the first half hour the internal temperature was brought up rapidly to the desired limit by applying a steady input considerably in excess of the final required amount. The input was then shut off to its estimated required steady value. The internal temperature would then drop slightly for an hour or so, after which it would slowly rise toward the limiting value. After seven or eight hours from the start, the rate of rise was found to be sufficiently small to enable the heat input to be taken as heat leakage without serious error; but if the heat had been kept on for, say, twenty-four hours, the internal temperature would probably have been appreciably higher and the leakage per degree appreciably less. The comparative leakage of heat with different oven walls would not be likely to differ appreciably with twenty-four-hour runs

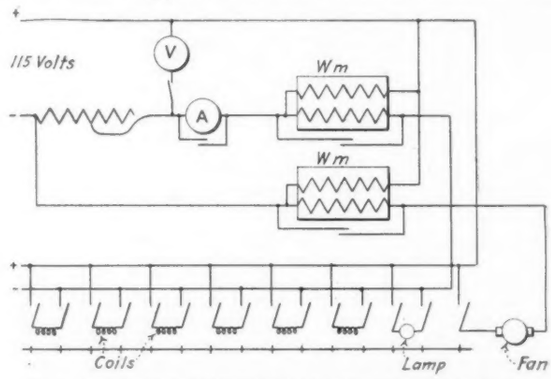


FIG. 4—INPUT CONNECTIONS OF ELECTRIC OVEN

or eight-hour runs, and it was the comparative rather than the absolute values that were sought for in these tests.

Wall Structures Tested

Five different kinds of wall were tried as follows:

(1) *Single Walls.*—In this test the outer shell of the double-walled oven was taken off, leaving the oven with

the single inner wall of asbestos-board. All joints in this single wall which seemed to be not quite air-tight were covered with magnesia plaster.

The tests made with single walls were as shown in Table II. Each occupied one day. By temperature rise in the table is meant the difference between the internal oven temperature and the external air temperature of the room at the end of the run.

TABLE II—TESTS MADE WITH SINGLE WALLS

Test No.	Temperature Rise, Deg. C.	Length of Run		Steady Input, Watts	Watts per Deg. C. Rise	Deg. C. Rise per Watt
		Hours	Min.			
1	18.8	7	45	677	36.0	0.0278
2	25.6	6	55	1015	39.7	0.0252
3	26.4	8	25	1027	38.9	0.0257
4	35.4	7	30	1540	43.5	0.0230
5	37.2	7	30	1481	39.8	0.0251
Mean..	.....	.....	.....	.....	.....	0.0254

The thermal resistance of the oven—that is, the ratio of the difference in temperature between the air inside of the oven and the external air of the room to the steady heat escape in watts—was $R = 0.0254$ thermal ohm.* The total wall area of the oven was approximately 69,000 sq. cm (10,700 sq. in.), and the average wall thickness 1.27 cm (½ in.), so that the thermal resistivity of the asbestos board forming the oven shell was $0.0254 \times 69{,}000 \div 1.27 = 1377$ thermal ohm-cm. This is in accordance with the value of the thermal resistivity of asbestos board given by C. P. Randolph in the *General Electric Review* for February, 1903; viz., 1140 to 1397 thermal ohm-cm (450 to 550 thermal ohm-inches).

(2) *Double Walls with Simple Air-Space Separation.*—When the outside shell of asbestos board was replaced on the oven, corresponding to the condition indicated in Figs. 1, 2 and 3, the series of observations given in Table III were taken. The above results indicate that adding the outer shell to the oven, or changing from a single to a double wall of asbestos board with a free air space between them, increased the wall thermal resistance from 0.0254 to 0.041 thermal ohm, or by about 60 per cent.

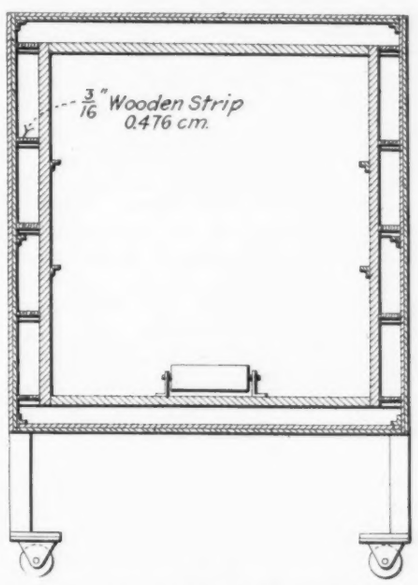


FIG. 5—CROSS-SECTION OF ELECTRIC OVEN WITH CELLULAR WALLS

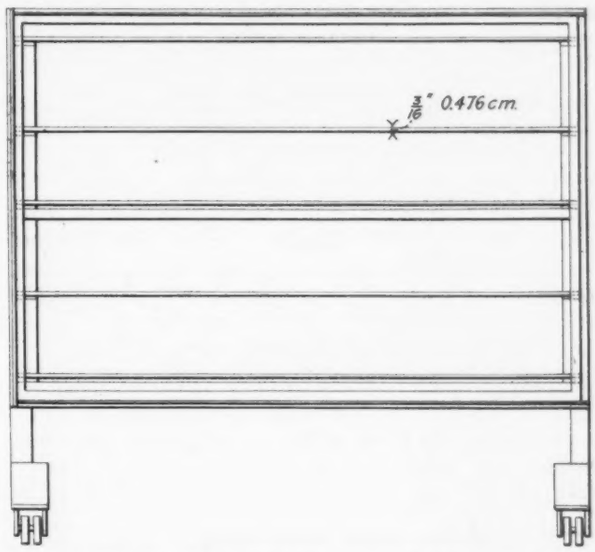


FIG. 6—LONGITUDINAL SECTION OF ELECTRIC OVEN WITH CELLULAR WALLS

(3) *Double Walls with Baffle Strips.*—In order to ascertain whether the thermal resistance of the double walls would be appreciably increased by breaking up the hollow space into cells, horizontal wooden strips were inserted at the sides and ends, between the outer and inner shells, as indicated in Figs. 5 and 6. These wooden strips were 5.3 cm wide and 0.5 cm (3/16 in.) thick. When inserted, they changed the vertical hollow walls from spaces 108 cm high to a series of cells, each 20 cm high, one above another. It was supposed that this breaking up of the walls into compartments might

TABLE III—TESTS MADE WITH DOUBLE WALLS AND AIR-SPACE SEPARATION

Test No.	Temp. Rise, Deg. C.	Length of Run		Steady Input, Watts	Watts per Deg. C. Rise	Deg. C. Rise per Watt
		Hours	Min.			
1	15.5	7	15	373	24.1	0.0415
2	23.9	8	5	578	24.2	0.0413
3	31.4	7	37	770	24.5	0.0408
4	41.2	7	25	1022	24.8	0.0403
Mean..	.....	.....	.....	.....	.....	0.0410

TABLE IV—TESTS MADE WITH DOUBLE WALLS AND BAFFLE STRIPS

Test No.	Temp. Rise, Deg. C.	Length of Run		Steady Input, Watts	Watts per Deg. C. Rise	Deg. C. Rise per Watt
		Hours	Minutes			
1	19.1	7	20	443	23.2	0.0432
2	27.3	7	25	663	24.3	0.0412
3	40.2	8	5	1025	25.5	0.0392
4	42.8	8	40	1056	24.7	0.0405
Mean..	.....	.....	.....	.....	.....	0.0410

*"The Heating of Copper Wires by Electric Currents," by A. E. Kennelly and E. R. Shepard, *Transactions A. I. E. E.*, June 25, 1907, p. 974. "Simplification of Electrothermal Calculations: the Watt and Thermal Ohm," by Carl Hering, *Transactions A. I. E. E.*, June 25, 1912, p. 1191.

check the flow of internally contained air and so tend to increase their thermal resistance. The results given in Table IV were obtained. The average thermal resistance was therefore not appreciably increased by inserting the baffle strips in the walls.

TABLE V—TESTS MADE WITH DOUBLE WALLS PACKED WITH COTTON WASTE

Test No.	Temp. Rise, Deg. C.	Length of Run		Steady Input, Watts	Watts per Deg. C. Rise	Deg. C. Rise per Watt
		Hours	Minutes			
1	15	7	5	243	16.2	0.0617
2	23	7	40	382	16.6	0.0602
3	40.7	7	10	684	16.8	0.0595
Mean..	.....	.....	.....	.....	.....	0.0605

(4) *Double Walls Packed with Cotton Waste.*—The baffle strips used in the preceding series of tests were removed, and the hollow space between the two shells of the oven was filled with loosely packed dry cotton waste. The series of measurements shown in Table V were then made. The effect of packing the double walls with cotton waste was to increase their resistance from 0.041 to 0.0605 thermal ohm, or by nearly 50 per cent.

TABLE VI—TESTS MADE WITH DOUBLE WALLS PACKED WITH METALLIC WOOL

Test No.	Temp. Rise, Deg. C.	Length of Run		Steady Input, Watts	Watts per Deg. C. Rise	Deg. C. Rise per Watt
		Hours	Minutes			
1	12.75	7	30	165.7	13.0	0.0769
2	12.6	8	0	163.9	13.0	0.0769
3	21.4	7	0	301	14.05	0.0712
4	25.0	7	10	298.8	11.95	0.0837
5	31.0	7	15	395	12.73	0.0786
6	43.5	7	30	544	12.50	0.0800
Mean..	.....	.....	.....	.....	.....	0.0779

(5) *Double Walls Packed with Metallic Wool.*—The cotton waste packing used in the preceding series was removed and replaced by so-called "metallic wool." This is the trade name of a substance resembling ordinary wool in appearance but consisting of a mineral substance procured in Indiana. The material is fused and then blown out by compressed air. It is non-inflammable and is therefore preferable to cotton wool as a packing for oven walls. The series of results given in Table VI were then obtained.

TABLE VII—SUMMARY OF RESULTS FROM THE VARIOUS TESTS

Series	Nature of Wall	Watts Input per Deg. C. Rise, Thermal Mhos	Deg. C. Rise per Watt Input, Thermal Ohms	Thermal Resistance Ratios	
1	Single shell.....	39.4	0.0254	1	
2	Double shell and simple air space.....	24.4	0.0410	1.62	
3	Double shell and cellular air space.....	24.4	0.0410	1.62	1
4	Double shell packed with cotton waste.....	16.5	0.0605	2.38	1.47
	Double shell packed with metallic wool.....	12.8	0.0779	3.07	1.9

A series of tests maintained with an input of 170 watts was continued for twelve hours. The rise of temperature during this run indicated that the thermal time-constant of the oven was roughly four hours. It is evident that the metallic-wool packing increased the thermal resistance of the walls 200 per cent above that of a single shell. No attempts were made to compare the effects of metallic wool with other known heat insulators such as flocculent magnesia, nor have we reason to suppose that the metallic wool is exceptionally advantageous in this respect.

Table VII summarizes the results in the various series.

Synopsis

The ovens provided with double walls containing a simple air space between them showed about 60 per cent more thermal resistance to the escape of heat than a single wall, after a steady input for from seven to eight hours. Inserting a few horizontal wooden strips into the walls to break up the air space into compartments had no appreciable effect. Packing the hollow walls with loose dry cotton waste increased the double-wall thermal resistance nearly 50 per cent, and packing with a loose flocculent mineral substance nearly 90 per cent.

The Distinction Between Cost and Value

The first fundamental principle in the valuation of physical property, concerning which much confusion exists, said Mr. Kempster B. Miller in an address before the National Independent Telephone Association at Chicago lately, is the distinction between cost and value. Value is likely to differ widely from cost, and the more widely the two are separated in point of time the greater is the difference likely to be. For instance, asked Mr. Miller, will anyone say that a piece of real estate in what is now downtown Chicago which fifty years ago cost $10 has a value of no more than that now? Or is the value of a crate of apples which has rotted on the owner's hands to be measured by the cost of those apples a month ago? Conversely, the closer together the time of purchase and the time of valuation are the more nearly is cost likely to approximate and to be a true measure of value. When the date of cost and the date of valuation are coincident, cost is likely to be a fair measure of value. It is for this reason that the courts have held that the cost of reproduction is one of the important things to consider in arriving at the value of a physical property. Unfortunately for the reproduction theory of determining cost as a means of measuring value, it is not feasible to tear down the plant and build it again so as to find out how much it would cost to reproduce it now.

The only alternative, in order to arrive at the cost of reproduction, is to make as close an estimate as possible of the hypothetical reconstruction of the plant at the present time. This does not mean that in this hypothetical process impossible things are to be assumed, as, for instance, that the plant is to spring into existence overnight as if by a miracle. "Obviously," continued the speaker, "we must confine ourselves to what is humanly possible; and this means that we must allow a reasonable period for our hypothetical reconstruction, and that we must consider not only those costs which enter into the purchase of material and the payment of wages but also all collateral costs which would reasonably and necessarily enter into the construction of the plant."

FACTORS IN RATE-MAKING—II

Considerations That Govern Rates and Some New Forms of Utility Schedules

BY ARTHUR S. IVES

The factors which must be determined for each rate are as follows:

F = Fixed charge per day per kilowatt of station demand based on the total investment required to serve the consumers of the particular class under consideration, also on all costs of the distribution system in its broadest sense.

V = Operating charge per kilowatt-hour, including consumer charges.

I = Interweave, or ratio of station demand to sum of consumers' demands.

N = Number of hours' average use per day of consumers' maximum demand, to be covered by required minimum monthly guarantee.

M = Number of hours' average use per month of consumer's maximum demand, to be covered by required minimum monthly guarantee.

W = Percentage to be allowed as wholesale discount per each $10 of net monthly bill, to take account of the reduction in "consumer charge" per kilowatt-hour consumed by large users.

C = Amount of cash or prompt-payment discount to be included in rate.

D = Individual diversity factor, or ratio of consumer's maximum demand to his total connected load. (This is important only where actual demand must be estimated.)

Of these factors F and V must be determined by analysis of the company's records. As an example assume a company serving two communities, their centers of population being 20 miles apart, with the generating station on the outskirts of one and 18 miles from the other. We will have a primary classification into geographical zones, one for each community, and separate rate factors shall be determined for each. The difference in results may be so small that it would not warrant two separate rate schedules, but before this can be known the analysis must be made. For this example it will not be necessary to consider other forms of primary classification as the principles are the same.

As a secondary classification we will assume the following simple division into municipal street lighting, commercial lighting, residence lighting, commercial motor service and wholesale motor service (sold at generating-station switchboard).

These two classifications are sufficient for the determination of the factors F and V.

Assume that the company is subject to the jurisdiction of the New York Public Service Commission, Second District, and conforms to its standard system of accounts. Most of the other state commissions have used this system as a model, so the variations are not very considerable.

Capital Accounts

What we propose to do is to determine these factors simultaneously for all classes of consumers. We must first ascertain the capital investment required by each class. Let us prepare a form as shown in Table I, using a separate column for each class and a separate line for each item of accounts, and distributing each such item to the classes to which it applies. The distribution of the capital accounts to the various classes will be obvious to one who knows local conditions, and the total for each column will give the investment figures on which interest and profit should be allowed.

F shall be a function of the "fixed charges" consisting of interest, amortization, insurance (other than liability) and taxes. The first follows directly from the total investment as found and the other three are taken directly from the operating expense account, so that the whole may be as shown in Table II. The figures in the last line of Table II give the values of F for each class respectively.

Operating Expenses

In similar manner factors V may be determined from operating expenses, but in this case the unit cost will be obtained directly by dividing the total yearly expense for each item of accounts by the total kilowatt-hours sold to all the classes to which such item is to be prorated. For example, if the yearly total cost for account No. 543, "Commercial Incandescent Operation," is $1,200, and it applies to commercial and residence lighting in both zones, the kilowatt-hours sold per year are added to the four classes, and the total sum is divided into $1,200. The result is the cost per kilowatt-hour of this item for each class. Table III shows the form.

The factor I must be determined from experience,

TABLE I—CAPITAL INVESTMENT FOR EACH CLASS

N. Y. State Acct. No.	Account or Item	Total Value	Zone No. 1					Zone No. 2				
			Municipal Street Lighting	Commercial Lighting	Residence Lighting	Commercial Motor Service	Wholesale Motor Service	Municipal Street Lighting	Commercial Lighting	Residence Lighting	Commercial Motor Service	Wholesale Motor Service
101	Organization											
102	Franchises											
103	Patent Rights											
104	Other Intangible Capital											
110	Land											
121	General Structures											
122	General Equipment											
131	Dams, Canals and Pipe Lines											
132	Power-Plant Buildings											
141a	Furnaces, Boilers and Accessories											
141b	Steam Engines											
142	Turbines and Waterwheels											
143a	Gas Producers and Accessories											
143b	Gas Engines											
144a	Electric Generators											
144b	Accessory Electric Power Equipment											
145	Miscellaneous Power-Plant Equipment											
151	Substation Buildings											
152	Substation Equipment											
161	Poles and Fixtures											
162	Underground Conduit											
163	Transmission System											
164	Distribution System											
165	Line Transformers and Devices											
166	Electric Services											
167a	Electric Meters											
167b	Electric-Meter Installation											
171	Municipal Street-Lighting System											
172	Commercial Arc Lamps											
173	Glower Lamps											
174	Electric Motors and Heaters											
175	Electric Tools and Implements											
176	Electric-Laboratory Equipment											
177	Other Tangible Electric Capital											
281	Engineering and Superintendence											
282	Law Expenses during Construction											
283	Injuries during Construction											
284	Taxes during Construction											
285	Miscellaneous Construction Expenses											
286	Interest during Construction											
10	Materials and Supplies											
1	Working Capital											
	Total investment											

checked or compared with all available similar experience and data of other companies. It is not difficult to ascertain the consumers' demands individually or in groups, but it is seldom that conditions permit a company to serve only a single group of consumers at one time and thereby ascertain the actual interweave by comparison of the observed station demand with the sum of the consumers' demands for that particular group. Sometimes this can be done, but generally the various values of I for different classes must be determined by approximation from available records, taking two or more groups at a time.

From the writer's experience the following is the approximate range of values of I: Municipal street lighting, 1.00; commercial lighting, 0.80 to 0.90; residence lighting, 0.70 to 0.80; commercial motor service, 0.30 to 0.40; wholesale motor service, 0.50 to 1.00.

The value of I for wholesale motor service may be much higher than for commercial motor service when the number of consumers is small, and will reach 100 per cent whenever there is only one consumer in the class. The same reason applies to street lighting in which there is only one consumer in the class. It is assumed that there are a considerable number of consumers in each of the other classes.

The next factors, N and M, may be fixed arbitrarily but should depend on the use which average consumers make of their demand. N and M should be so selected that the resulting allowance of kilowatt-hours which a consumer is permitted for his monthly guarantee will not be greater than the average use of the average consumer. This will stimulate increased use by the average consumer, who would then have to pay only the low excess rate for such increase, and will also stimulate the smaller consumer to use up his guaranteed allowance, and so tend to raise him to the average. Fair values of N and M for the different classes, would generally be as shown in Table IV.

We can compute primary and secondary rates and monthly guarantees by the following formulas:

$$\text{Primary rate per kilowatt-hour} = \frac{F \times I}{N} + V$$

$$\text{Secondary rate per kilowatt-hour} = V$$

$$\text{Monthly guarantee per kilowatt of consumers' demand} = \frac{F \times I \times M}{N} + VM$$

$$\text{Kilowatt-hours allowed per month for guarantee} = M \times \text{consumers' demand in kilowatts.}$$

TABLE II—FIXED CHARGES, AND VALUES FOR E

N. Y. State Acct. No.	Account or Item	Total Value	Zone No. 1					Zone No. 2				
			Municipal Street Lighting	Commercial Lighting	Residence Lighting	Commercial Motor Service	Wholesale Motor Service	Municipal Street Lighting	Commercial Lighting	Residence Lighting	Commercial Motor Service	Wholesale Motor Service
	Total investment											
	Per cent return on same											
842	General Amortization											
838	Insurance (except Liability)											
860	Taxes											
	Total fixed charges per year											
	Total fixed charges per day											
	Maximum station demand in kilowatts											
	Total fixed charges per day per kilowatt of maximum station demand = F											

TABLE III—OPERATING EXPENSES

N. Y. State Acct. No.	Account or Item	Total Value	Zone No. 1					Zone No. 2				
			Municipal Street Lighting	Commercial Lighting	Residence Lighting	Commercial Motor Service	Wholesale Motor Service	Municipal Street Lighting	Commercial Lighting	Residence Lighting	Commercial Motor Service	Wholesale Motor Service
	Kilowatt-hours sold											
501	Station Superintendence and Labor											
502	Fuel for Power											
503	Water for Power											
504	Lubricants for Power											
505	Production Supplies and Station Expense											
507	Repairs of Power-Plant Buildings											
508	Repairs of Furnaces, Boilers and Accessories											
509	Repairs of Steam Engines											
510	Repairs of Hydraulic Power Plant											
511	Repairs of Gas Power Equipment											
512	Repairs of Power Plant Electric Equipment											
513	Miscellaneous Station Repairs											
514	Steam Purchased											
515	Power Gas Purchased											
516	Electric Energy Purchased											
521a	Transmission Subway Rent											
522a	Transmission Pole and Fixture Repairs											
523a	Transmission Underground Conduit Repairs											
524	Transmission System Repairs											
525	Substation Labor											
526	Substation Supplies and Expenses											
527	Repairs of Substation Buildings											
528	Repairs of Substation Equipment											
529	Electric Storage Expenses											
531	Electric Distribution Superintendence											
532	Electric Distribution Records and Expense											
533	Setting and Removing Meters and Transformers											
521b	Distribution Subway Rent											
522b	Distribution Pole and Fixture Repairs											
523b	Distribution Underground Conduit Repairs											
534	Distribution System Repairs											
535a	Repairs of Electric Services											
535b	Repairs of Transformers											
536	Electric Meter Operation and Repairs											
541	Commercial Arc Operation											
542	Commercial Arc Repairs											
543	Commercial Incandescent Operation											
544	Consumers' Installation Expenses											
545	Municipal Street Arc Operation											
546	Municipal Street Arc Repairs											
547	Municipal Street Incandescent Operation											
548	Municipal Street Incandescent Repairs											
551	Commercial Administration											
552	Promotion Expenses											
832	General Officers and Clerks											
835	General Office Supplies and Expenses											
836	General Law Expenses											
837	Miscellaneous General Expenses											
838	Insurance (Liability only)											
839	Relief Department and Pensions											
840	Electric Franchise Requirements											
845	Electric Expenses Transferred—Cr.											
846	Joint Operating Expense—Cr.											
847a	Accidents and Damages											
847b	Law Expenses connected with Damages											
848	General Stationery and Printing											
850	Store and Stable Expenses											
852	Undistributed Adjustments—Bal.											
853	Duplicate Electric Charges—Cr.											
870	Uncollectible Electric Bills											
	Total = V = Operating charge per kilowatt-hour sold											

These should be computed for each class, using in turn the respective constants for different classes.

Wholesale Discounts

It remains to fix a proper schedule of wholesale discounts. Referring to Table III and the accompanying discussion, it will be recalled that we included in "operating cost" the items previously designated as "consumer costs." Theoretically consumer costs should be the same per consumer and not per kilowatt-hour, and on such a basis the larger the number of kilowatt-hours per consumer the smaller should be the amount per kilowatt-hour included in the rate to cover consumer cost. This fits in with the "wholesale" principle and enables us to make proper allowances by wholesale discount and avoid what would otherwise be an excessive rate for large consumers. We take from Table III the items of "consumer costs," which will include accounts Nos. 551 ("Commercial Administration") and 552 ("Promotion Expenses") and may include some other items according to the policies of the company. Then, for each class of consumers let

A = total yearly income in cents.
B = total yearly "consumer cost" in cents.
C = total yearly kilowatt-hours sold.
D = average total number consumers during year.
E = actual maximum monthly kilowatt-hours of any consumer.
F = corresponding monthly bill at gross rate.
G = average monthly bill.
H = average "consumer cost" per month per consumer.
K = average "consumer cost" per kilowatt-hour (included in gross rate).
L = minimum cost per kilowatt-hour at gross rate.
M = maximum percentage wholesale discount to apply to F. Then

TABLE IV—FAIR VALUES OF N AND M FOR DIFFERENT CLASSES

	N	M
Municipal street lighting	12	360
Commercial lighting	1⅗	50
Residence lighting	1	30
Commercial motor service	1	25
Wholesale motor service	4	100

$$\frac{A}{12D} = G, \quad \frac{B}{12D} = H, \quad \frac{B}{C} = K,$$

$$\frac{F}{E} = L, \quad \frac{K - \frac{H}{E}}{L} = M, \text{ or}$$

substituting for H, K and L and reducing we have

$$M = \frac{B(12DE - C)}{12CDF}.$$

The theoretical curve of wholesale discounts can be plotted, using "percentage of discount" as ordinates and "monthly bill at gross rate" as abscissas. The discount should be zero at the point corresponding to the average monthly bill G, and equal to M at the point corresponding to maximum monthly bill E. Other points may be determined by the same formula, substituting intermediate values of gross monthly bill and corresponding kilowatt-hours for E and F.

The higher the total "consumer cost," the larger will be the wholesale discounts that can be allowed; where consumer costs are high the kilowatt-hour rate for larger consumers will be low.

Theoretically the cash discount C should be equal to the cost of collecting bills if delinquent. Properly speaking, it is, therefore, of the nature of a "consumer charge," but most companies have preferred to apply it as a reduction in the rate per kilowatt-hour. As a general rule it should be not less than 5 per cent nor more than 10 per cent of the rate, but need not be in form of a percentage. An equivalent amount should be included in the final make-up of the rate, so that after deduction as a cash discount the company will receive the net amount determined. If the consumer does not pay promptly, the extra amount received will apply toward cost of collection.

Some companies have substituted penalty for nonpayment in place of discount for prompt payment, but this is not considered the best public policy.

The individual diversity factor D need not be considered at all in rate-making if the consumers' maximum demand is measured directly by some form of meter. In small installations the cost of such a meter is prohibitive, and the demand is generally estimated as a percentage of connected load. Such percentage is, by definition, equal to D. Here again experience and comparison with records of other companies must be used for equitable results. Tables V and VI show schedules of the values of D, for commercial lighting, residence lighting and motor service, which have been prepared very carefully from such considerations and which undoubtedly present average conditions very closely. It will be noted that for motor service the value of D varies with the number of connected motors as well as with their total aggregate horse-power.

TABLE V—INDIVIDUAL DIVERSITY FACTOR, SHOWING VALUES OF D FOR LIGHTING

Kilowatts of Connected Load	For Commercial Lighting, per Cent	For Residence Lighting, per Cent
0.50 (and less)	100.00	100.00
0.75	96.67	90.00
1.00	95.00	85.00
1.25	94.00	78.00
1.50	93.33	73.33
1.75	92.86	68.57
2.00	92.50	65.00
2.25	92.22	62.22
2.50	92.00	60.00
3.00	91.67	60.00
3.50	91.41	60.00
4.00	91.25	60.00
4.50	91.11	60.00
5.00	91.00	60.00

TABLE VI—INDIVIDUAL DIVERSITY FACTOR, SHOWING VALUES OF D FOR MOTOR SERVICE

Size and Total Horse-Power of Connected Motors	Number of Motors, 1 Hp and Larger				
	One	Two	Three, Four or Five	Six, Seven, Eight, Nine or Ten	Eleven or More
Less than 3 hp	1.00	0.90	.....	.....	.....
3 hp to less than 5 hp	0.90	0.85	0.80	.....	.....
5 hp to less than 7 hp	0.85	0.80	0.75	0.70	.....
7 hp to less than 10 hp	0.80	0.75	0.70	0.65	.....
10 hp to less than 20 hp	0.75	0.70	0.65	0.60	0.60
20 hp to less than 35 hp	0.70	0.65	0.60	0.55	0.55
35 hp and over	0.65	0.65	0.60	0.55	0.50

This completes the list of factors stated at the beginning of Part II and gives all data required to prepare a complete rate schedule for classes of service under con-

sideration. These same rate factors can be used as the basis of any other desired form of load-factor rate.

Return on Investment

If cost figures only have been used in the analysis, it will be necessary to add a proper amount for profit in fixing the rates themselves. Profit should be so divided that both fixed constants and variable constants will carry their proper share. The total amount should produce an equitable and adequate return on the investment. A discussion as to the percentage of return on investment which would be considered equitable and adequate is outside of the province of this paper, except that, as in any other business venture, the return should be commensurate with the risk. The various public service commissions which have made rulings seem to have shown a disposition to give companies proper consideration along these lines, and doubtless they will continue to do so.

(*To be continued*)

Practical Operation of Central Stations

Managers Discuss Frankly the Daily Problems of Operation Before the New England Section of the N. E. L. A.

THE New England Section of the National Electric Light Association held a "question box" convention at Boston, Mass., on March 11 and 12, with a total attendance of about 300. The meetings were unique in the entire absence of prepared papers or addresses, the whole time being devoted to discussion of practical topics. The program included an informal dinner at the American House on March 11 and visits to the Boston Automobile Show on the evenings of the two days. Much enthusiasm characterized the meetings on account of their informality and close association with daily problems. A résumé of the discussions is given below, classified according to general subjects.

Steam-Plant Practice

Mr. Welles E. Holmes, Cambridge, Mass., outlined the elimination of smoke in the plant of the Cambridge Electric Light Company by the use of Taylor stokers. He pointed out that smokeless firing can be secured by hand stoking under constant supervision, but emphasized the value of the continuous service secured in mechanical firing. At Cambridge the boiler capacity was increased by the stoker installation. It was found essential to keep the firemen from dumping the ash too frequently, as this leads to the waste of unconsumed fuel. Mr. John Seed, Worcester (Mass.) Electric Light Company, said that at his company's Webster Street station the rate of combustion could not be forced to 50 lb. or 60 lb. per sq. ft. of grate per hour without smoking. The best running point of the boilers is at about 150 per cent of their rating, although the boilers have been run at 300 per cent rating. Smoke begins to appear at about 200 per cent to 250 per cent of rating. Mr. R. W. Rollins, Worcester, cited the deposit of soot from the stack when the draft was increased from 3.5 in. to 5 in. It was pointed out that the Cambridge boilers ran at from 175 per cent to 200 per cent of rating without smoking except slightly when fires were cleaned. Clinker has been largely overcome in a Cape Cod plant by turning the tuyères around and boring holes in them to improve the air supply.

One company reported trouble due to hunting of engines when two generating units were operated in parallel, and it was suggested that this probably was due to irregularities in governing. In a similar case the difficulty was eliminated by clamping the governor of one engine and governing from the second unit, as in groups of hydroelectric stations.

Generators, Motors, etc.

The effect of excessive heating of the rotor of an induction motor was shown to be an increased drop in speed and increased loss in watts, reducing the efficiency. One speaker pointed out that he saved much time in putting in the brushes and grid in a General Electric form L induction motor by using a template composed of three pieces of tin on three sides of a triangle as a guide. Another member cut down the total interruption from service of a hoisting motor to two and one-half hours by welding an armature shaft which twisted off, by the autogenous method, the shaft then being straightened and turned before going back into use. Discussing this, Mr. W. H. Vorce, St. Albans, Vt., urged great caution in welding by the autogenous method, contending that this work should be done only by persons skilled in its handling. A skin weld easily can be made, but this will not hold. Thermit welding had been found more successful in repairing a waterwheel shaft which broke off in a rear journal box in a plant where six weeks would have been required to get a new shaft. At first an oxy-acetylene weld was tried, but only a skin weld resulted, and the task was then accomplished by the use of the thermit process. Mr. D. J. De Courcy, Lawrence, Mass., cited a case where a shaft was repaired by turning it down from ⅛ in. to ¼ in. and shrinking on a new bushing. Mr. F. C. Campbell, Cambridge, closed this part of the discussion by calling attention to the practice of posting a list of "don'ts" near the starting switch of every motor and taking the customer's receipts for each list.

Switchboards and Instruments

One company reported that to slot and shape marble or slate in position it uses a high-speed power hack-saw blade ground like a keyhole saw and clamped in a "Kerfed" wooden handle. Near live wires this tool can be used dry. Enameled conduit was recommended for connecting oil switches, the advantages being increased stiffness, straightness and no painting requirements.

The point was made that the Boston Edison company requires the installation of reverse-phase relays in elevator motor equipments to protect the motor against a reversal from without. Some users of no-voltage-release coils reported trouble from burn-outs when the voltage rose to a point 10 per cent above normal. Mr. W. R. Eaton, Cambridge, stated that a reverse-phase relay will not help materially in an elevator motor installation equipped with a mechanical brake only.

Several companies reported successful experience with pole-type regulators. At Worcester, Mass., a fortnightly inspection is given. The motors run all the time, and in eighteen months' service on one equipment little attention has been required. One speaker said that when a pole-type regulator of early design was first placed in service the local board of health required its removal on account of noise, but recent designs are unobjectionable. Mr. W. P. Schwabe, Windsor Locks, Conn., said

that a regulator was notably useful on a feeder 7 miles long, when placed on the station side of a booster transformer 4 miles from the generating plant. In this case a 15-hp refrigerating motor is in service at the end of the line on an off-peak contract limiting its service from 10 p. m. to 4 p. m. In another case an Anderson low-voltage time switch is used to disconnect the motors in two pole-type regulators during the daytime, without injuring the voltage regulation perceptibly. By this means heating of motor coils had been greatly reduced. The regulators were connected in a two-phase light and power feeder circuit, and the motors were of a three-phase, high-torque design. The voltage fluctuations caused by the power load in the day led to heating, even when the motors were operated for but a few minutes under these conditions. The time switch was installed in the secondary of the motor, and charts taken by an automatic instrument showed as good regulation in the day without the motors in service as when they were used.

On another system a potential regulator in an outside transformer house caused trouble by either raising or lowering the voltage in jumps or "hanging up" at its high and low point. The trouble found was that the primary relay was not level and the guides on the solenoid had worn a hollow in its bearing and would stick. The relay was leveled, the bearing reamed out, and the trouble overcome. A discussion took place about the desirability of inspecting starting compensators in consumers' installations. Several of the members favored this plan as a service which can be rendered to the customer at very little additional cost. Experience as to the need of changing transformer and oil-switch oil occasionally varied widely. The Cambridge Electric Light Company draws off and replaces the oil in all service transformers each summer. The Salem (Mass.) company makes a yearly test for grounds with a portable 10-watt lamp on all service transformers, and checks up the oil level. The Buzzards Bay company sends a letter each fall to schools, asking teachers to impress upon children the danger of touching loose outdoor wiring.

An effective "safety first" scheme used by a Connecticut company is the monthly offering of a first and a second premium to any employee reporting conditions in any of the company's property that might cause injury to either employees or to the public, or that might cause preventable waste. Since the institution of this offer on July 1, 1914, no reports from the public about unsafe conditions have been received, and it is becoming increasingly difficult for employees to find any such conditions to report.

When no protective devices are installed on constant-current transformers, one company arranges an alarm bell to ring in case of an open circuit. The same company installed a discarded 50-watt, 2200-to-110-volt potential transformer on a 220-volt lighting circuit to supply current for the operation of signal bells and horns.

Line Construction

A question was raised relative to the amount of business necessary on line extensions to justify their construction. Mr. F. J. Lyon, Waterbury, Conn., stated that at least $35 per year should be obtained for each $100 of investment, based on an allowance of 9 per cent depreciation, 6 per cent interest, and 50 per cent of the gross receipts for operating expenses. Another speaker said that the average gross revenue of all the central stations in the United States is $13.50 per $100 of investment. One company reported that in removing and replacing electrodes in magnetite-arc lamps a pair of pliers may be used to good advantage, saving time and with less danger of breaking the globe than by the usual hand method. An engineer numbers, initials and designates cables in underground service, and marks poles and cross-arms with a durable composition tag, doing away with the stenciling of this equipment. A cheap and effective method of protecting the ends of cable in iron-base ornamental lamps is to use a porcelain bushing, 1 in. in diameter and 6 in. long, filled with compound.

Mr. E. W. Bates, Plymouth (Mass.) Electric Light Company, stated that both the bow-arrow and wishbone type of cross-arm are used on his system, with a considerable saving on lines of 2300-volt service or higher extending for some distance without customers. The extra strength of the arm permits spacing the poles from 200 ft. to 250 ft. apart, thus reducing the cost to such an extent that many times a line which would not prove satisfactory under ordinary construction can be built using this material. Although the cost of the arms and pins is nearly two and one-half times that of wooden cross-arms and pins, the pole spacing reduces the cost about $225 per mile, using 40-ft. poles. On a 10-mile line this saving was thus $2,250. The company has used Pierce specialties for connecting customers and running secondaries. Although the first cost may exceed that of wooden construction, the low maintenance expense more than makes up for the interest on the investment.

Lamps

The point was made that film cut-outs cannot be used satisfactorily on series-tungsten lamps. Trouble has been experienced with these lamps from explosions on circuits supplied with rectified current. Several companies favored the practice of charging for lamps renewed, paralleling the practice of gas companies with respect to mantle renewals. One speaker stated that local lighting circuits in dwellings could be effectively protected against the effects of radio installations by the use of a telephone-type condenser with cut-outs on each line. A good deal of business can be obtained through the interest of the wireless amateur. Where serious difficulties have been encountered one company has made a charge of $2 per month above the bill and has installed a separate transformer. An incandescent lamp is used in cold weather on another system to warm the oil in a rectifier while the apparatus is out of service.

Distribution Systems

Mr. A. D. Colvin, Hartford, Conn., stated that by the use of synchronous condensers of the low-voltage type the power-factor has been much improved on the local system. Four are now in service. One of 200 kva is loaded with a 75-hp fan at the end of a 10-mile, 10,000-volt line and runs from 7 a. m. to 6 p. m. The power-factor has been raised to 92 per cent. Others are in factories having large induction motor installations. Savings in line construction have followed the use of this equipment, the power-factor being increased from 10 per cent to 15 per cent. In one factory the lighting company pays a local electrician 25 cents a day to start the condenser before 7 a. m. and care for cleaning. Mr. W. P. Schwabe, Windsor Locks, Conn., cited a case where the power-factor was raised from 55 per cent to 92 per cent by installing a 125-kva, 2300-volt synchronous condenser on a 40-hp load in an industrial plant.

Methods of grounding secondaries in towns without water supply systems were discussed. In one case a transformer supplied eight houses. The secondary was grounded to a coil of wire buried in coke, the ground being salted. In another case where a copper plate was buried in coke silicate of soda was effectively used.

Other topics discussed at the convention, dealing with the commercial side of central-station management, are referred to in the Commercial Section in this issue.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Series Transformer.—A. G. L. MCNAUGHTON.—A mathematical paper illustrated by diagrams in which the author gives expressions for hysteresis and eddy-current losses and for the ratio and phase angle of a series instrument transformer. A simple method of actually measuring the ratio and phase angle is described.—London *Electrician*, March 5, 1915.

Lamps and Lighting

Suit for Compulsory License for British Ductile Tungsten Patents.—An account of an interesting and important action which is now being heard before Justice Warrington in the Chancery Division in London, in which the Robin Electric Lamp Company, Ltd., is seeking a compulsory license under Section 24 of the patents act of 1907. The object is to manufacture drawn-tungsten wire under certain patents owned by the British Thomson-Houston Company and Siemens Brothers Dynamo Works, as it is alleged that these companies have refused to supply the Robin Electric Lamp Company with wire on reasonable terms.—London *Elec. Eng'ing.* March 4, 1915.

Generation, Transmission and Distribution

Buffer Batteries for Alternating-Current Systems.—L. SCHROEDER.—An illustrated account of experience with buffer batteries on alternating-current systems, the fundamental idea being shown in Fig. 1. *G* is the three-phase generator which supplies energy to the three-phase busbars *BC*, while *N* is the network. *MD* is a motor-generator, *M* being the three-phase motor and *D* a direct-current generator. The latter acts in co-operation with the storage battery *A*. In the busbars a series transformer is provided, the secondary current of which is rectified by means of the synchronous converter *R*. The direct current which comes from the synchronous converter *R* is approximately proportional to the current in the network and is used to regulate the booster *Z*. For this purpose the direct-current from *R* is passed through the magnetizing winding *ab* of the booster *Z*. This booster has also a second excitation winding *cd* which is charged from the battery *A*. The two excitation windings *ab* and *cd* act in opposition. They are so dimensioned that at the average load in the network the actions of the two windings counterbalance each other, so that the booster is non-

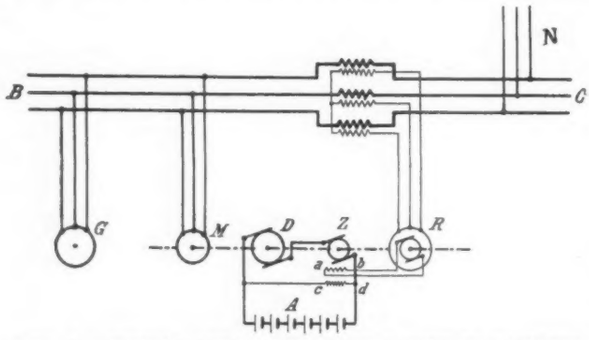


FIG. 1—WIRING ARRANGEMENT FOR BUFFER BATTERY

excited and the battery is neither charged nor discharged. If the load in the network increases, the action of the winding *ab* is greater than that of *cd*, and the booster is now excited in such a way that the storage battery is being discharged. The battery, therefore, drives the direct-current generator *D*, and the three-phase alternator *M* now becomes a generator and supplies energy to the network. On the other hand, if the load in the network decreases below the average value, the storage battery *A* is charged. For the regulating generator *R* use is not made of an ordinary synchronous converter, but of a Danielson converter, with the modification due to Woodbridge. This arrangement was used in tests in which the normal load

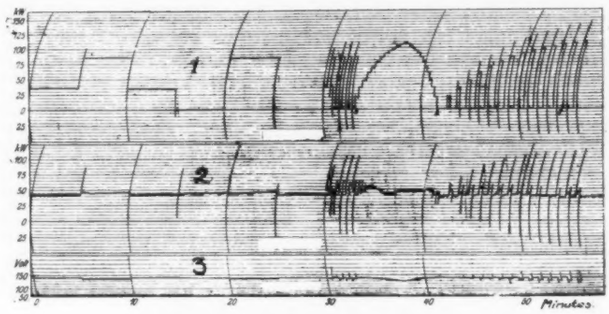


FIG. 2—RESULTS OF TESTS

of the network was 35 kw. The battery consisted of 106 cells, with a discharge current of 259 amp for one hour. The results of the tests are given in Fig. 2, in which curve 1 represents the load in the network in kilowatts, curve 2 represents the load of the dynamo in kilowatts, while curve 3 represents the voltage in the network. The abscissas represent minutes. It will be seen that even though the load in the network was increased to 108 kw—that is, more than three times the normal load—the buffer-battery arrangement acted quite satisfactorily. The results of some other tests are also given. The author shows how the system operates if the generator suddenly stops its work and the battery is forced to supply the whole current. The voltage in the network drops but can be brought up to its normal value quickly by a simple change of connections. The possibility of using an ordinary synchronous converter instead of a Danielson converter is finally discussed.—*Elek. Zeit.*, Feb. 11 and 18, 1915.

Installations, Systems and Appliances

Combined Flat Rate and Meter Rate.—FRANKLIN PUNGA.—The author thinks that some combination of flat rate and meter rate will in time replace all other methods of charging for electrical energy. The principal difficulty which must be solved in introducing such a combined rate, for instance as a substitute for a pure meter rate, is to find an exact method for determining the flat rate which is to be charged. Originally, the flat rate was based on the maximum demand, according to the system of Wright, but the author thinks that present practice tends to base it rather upon the aggregate rating of the connections or upon the floor area. It would be wrong to charge a flat rate directly proportional to the total installed connections, because this would induce most subscribers to reduce their installation to a minimum. Various methods devised to overcome this difficulty are described and discussed. The Marylebone schedule introduced by Seabrook does not charge any flat rate for energy-consuming apparatus except for lamps, and in the case of lamps a charge is made only for 70 per cent of all lamps installed, nor is any charge made for lamps installed for purely decorative purposes. For the connections calculated in this way a flat rate of $70 per kw is charged, while for every kilowatt-hour consumed 2 cents is charged. The so-called Potsdam schedule,

which is very similar to the American rate based on the floor area, makes a charge according to the size of the residence. The charge is independent of the connections installed per room. For a residence of three rooms a monthly flat rate of 63 cents is charged; for four rooms, 88 cents; for five rooms, $1.25; for six rooms, $1.75; for seven, $2.38. For larger residences 75 cents is charged for each additional room. No charge is made for kitchen, hall and servants' rooms. By combining the Marylebone schedule and the Potsdam schedule another schedule may be obtained which is not any more complicated than either of the two. The flat rate is divided into two parts, one part (*A*) depending on the size of the residence but not on the rating of the connections, and the other part (*B*) being proportional to the connections for lighting. If this part *B* is calculated on the basis of a very low charge per kilowatt of installed lamps, there is no danger that a consumer will install a minimum of lamps. For instance, a charge of 2.5 cents to 3.8 cents per month for each 25-cp lamp seems suitable. The portion *A* would be figured in a similar way as in the Potsdam schedule, but the basis would be a lower rate. The charge made for actual consumption should be not more than 2.5 cents per kw-hr. All these methods of charging for electrical energy have the common advantage that an ordinary meter may be used. The only difficulty is to determine in a just and fair way what the flat rate should

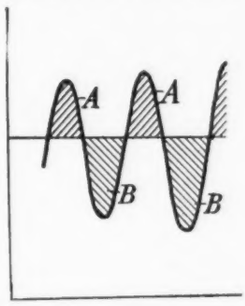


FIG. 3—PRINCIPLE OF CHARGING ON COMBINED FLAT RATE AND METER RATE

be. The present author describes a method of his own in which the determination of the flat rate is left to a certain extent to the consumer himself in so far as he has a right to say what his normal kilowatt rate shall be. He employs a meter which registers separately, first, the kilowatt-hours consumed above the agreed normal kilowatt consumption, and, second, the kilowatt-hours not consumed below the agreed normal kilowatt consumption. For the former, the peak kilowatt-hours consumed, a charge is made at a comparatively high rate, while for the latter, the valley kilowatt-hours *not* consumed, allowance is made on the bill at a comparatively low rate. The diagram of Fig. 3 illustrates the principle. The straight horizontal line represents the agreed normal kilowatt consumption, the shaded areas *A* the peak kilowatt-hours consumed, the shaded areas *B* the non-consumed valley kilowatt-hours. For *A* an additional charge is made to the consumer, for *B* a refund. According to the normal kilowatt consumption agreed upon by the consumer, the latter is at liberty, to a certain extent, to determine the flat rate himself. The author discusses how to figure the flat rate of the normal kilowatt consumption (on the basis of continuous consumption for 8760 hours), the rate for the valley non-consumption (refund), and the rate for the additional peak consumption (additional rate). He recommends that the rate for the additional peak kilowatt-hours should be lower in summer than in winter. Numerical expenses are added, and the effect of this method of charging on the finances of the central station is discussed.—*Elek. u. Masch.* (Vienna), Jan. 31, 1915.

Wires, Wiring and Conduits

Modern Methods of Electrical Wiring.—D. S. MUNRO.—A long abstract of a paper on this subject read before the Scientific Society of the Royal Technical College, Glasgow. The author described and criticised the methods ordinarily used, giving many practical hints, and showed a disposition to favor wood casing in preference to steel conduit for the protection of the wires. The subject of surface wiring was also dealt with, and the author described a new type of C. T. S. wiring which he had devised. Reference is made to the use of cab-tire sheathing. Although a rubber mixture, this material has no highly insulating qualities, and hence it is not generally used as an insulator but for mechanical and chemical protection. The sheathing has surprisingly good qualities of resistance to mechanical and chemical injury. To reduce minor disadvantages and make the system more widely suitable for surface or covered work, the author has recently devised a modified construction—the C. T. S. concentric system. The core consists of one or two tinned copper cables, rubber-insulated to the C. M. A. specification, and taped. Lapped closely around this is a ribbon of tinned copper wires. These are so laid that side-by-side contact is fully maintained. The whole is then taped and finally covered with a tough layer of cab-tire sheathing. The inner conductor is thus highly insulated and is doubly protected against injury, first by the copper windings of the exterior conductor and then by the resilient consistency of the outer sheath. Although the cable is made in concentric form, it is not intended that its use should be confined to installations planned on what is currently understood to be the concentric method. This method assumes that one pole is deliberately connected to "earth" at a point where the concentric system begins, usually at the main switch; also that single-pole switches and fuses on the live wire only are used. When, however, it is decided to carry out the work in this purely concentric-system manner, then the new form of cable possesses very distinct advantages over the metal-covered concentric cables hitherto employed, since potential differences between sections and dampness will not matter and will not set up electrolysis. The combined effect in the external conductor of the great copper area, of the longer length due to spiral winding, and of the side contact between turns of wires, is that the ohmic resistance of the external conductor is approximately half that of the inner. This apparent extravagance in copper is partly to provide armoring for mechanical protection. It has some advantage in reducing the temperature rise and the fall of potential. In most circuits the return wire has most current to carry as it serves more lamps than the individual switch wires. The cost of the extra copper is negligible as there are no expensive Para rubber coverings to go over it. The chief advantage of the system is that there is no external metallic surface to carry leakage and short-circuit currents throughout a building to points of danger. Like wood casing, its outer protection is an insulator, but, unlike wood casing, it is damp-proof and acid-proof.—London *Elec. Review*, Feb. 19, 1915.

Electrophysics and Magnetism

Electrical Resistance of Pure Iron.—G. K. BURGESS AND I. N. KELLBERG.—An account of a careful experimental investigation of the electrical resistance and critical ranges of pure iron. The resistance of iron increases from 0 deg. C. without any anomalies, with a gradually increasing temperature coefficient, to above 650 deg. C., or until the neighborhood of the recalescent

point $A2$ is reached. As $A2$ is approached the resistance rises rapidly, and at $A2$ there is an inflection in the resistance-temperature curve shown as a cusp at 757 deg. C. in the temperature-coefficient curve. At $Ac3$ the resistance of iron falls abruptly by some 0.005 of its value, which is recovered within a 25-deg. interval, and above $Ac3$ it increases gradually again. On cooling, the reverse phenomenon is observed at $Ar3$, which is accompanied by a slight increase in resistance with falling temperature, preceded by an interval of relatively slight changes in resistance.—*Scientific Papers*, Bureau of Standards, No. 236.

Units, Measurements and Instruments

Tests of Large Steam Hoists.—H. E. SPRING.—In order to present a convincing argument for the substitution of electric motors for existing steam-engine equipment on mine hoists, it is necessary to be able to show the mine owner some figures on cost of operation, as the question of economy is uppermost in any undertaking that is conducted for profit making. Complete and accurate tests on motor-operated hoists may be obtained with relatively little difficulty, but a test of the average steam hoist, to be of value, involves a great amount of work and oftentimes proves to be a serious problem. In this article the author recommends a procedure for conducting tests on steam-operated hoists that will give accurate figures on performance and cost of operation over any desired period of time. The author gives in detail the different steps in the preparation of the test and the procedure in carrying it out and in making the necessary calculations from the results obtained. He then shows how to prepare the report to be of the greatest help.—*Gen. Elec. Review*, March, 1915.

Single-Phase Induction Meter.—An official communication by the Reichsanstalt admitting for calibration a single-phase induction meter of Landis and Gyr. Its construction and method of calibration are described.—*Elek. Zeit.*, Feb. 18, 1915.

Telegraphy, Telephony and Signals

Vacuum Tubes for Telephone-Line Protection.—FRITZ SCHROETER.—Carbon lightning arresters protect against voltages above 3000. To protect telegraph and telephone lines against lower voltages, vacuum tubes are used and are of excellent service for protection against voltages above 300. The present author describes a new

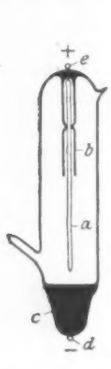
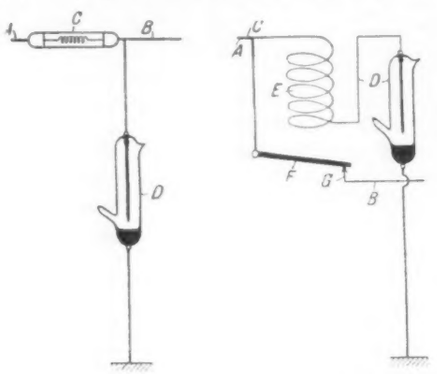


FIG. 4—VACUUM TUBE



FIGS. 5 AND 6—WIRING CONNECTIONS IN VACUUM-TUBE PROTECTIVE SYSTEM

form of vacuum tube which is effective down to 130 volts. The construction is shown in Fig. 4. The anode a is an aluminum pin surrounded by a protective tube b. The lower end of the anode a is at a distance of a few millimeters from the cathode c, which is a fused alloy of potassium or sodium. Current is supplied through platinum wires d and e. The tube is filled with helium, neon, argon, or a mixture of these gases at a pressure of from 1 mm to 3 mm. The life of the tubes is practically unlimited. A tube will withstand thousands of break-downs without change of its critical voltage. This vacuum tube may be used with the connections of either Fig. 5 or Fig. 6. In the first case the fuse C (operating at about 0.5 amp) is inserted between the telephone transmission line A and the exchange line B. The vacuum tube D is inserted in an earth connection as shown. If the telephone transmission line should by accident get into contact with an energy-transmission cable charged to more than 130 volts, or if voltages of this amount should be produced by induction in the telephone line, an arc is formed in D and the fuse C melts, whereby the exchange line B is separated from the transmission line. In the second arrangement (Fig. 6) the telephone transmission line A is separated from the exchange line B by a relay consisting of three parts, E, F, G. The winding E has a high resistance, say, 8000 ohms to 15,000 ohms. When a dangerous voltage occurs a brush discharge takes place in the vacuum tube D (because the high resistance of E prevents the currents reaching an intensity sufficiently high for the evaporation of the cathode which would produce an arc). The current passing through E excites the relay and attacks the armature F so that the contact between A and B is broken. The interruption lasts as long as the dangerous voltage in A and stops automatically when the dangerous voltage disappears. By artificial means it is possible to devise vacuum tubes which will operate below 110 volts. For instance, if a is used as the cathode, the surface being covered with a layer of potassium, and a distance of 5 mm is employed between a and c with a gas mixture of two-thirds neon and one-third helium at a total pressure of 2 mm, the break-down emf is 104 volts. A variation in the width of the vacuum tube has an effect on the critical voltage.—*Elek. Zeit.*, Feb. 18, 1915.

Book Review

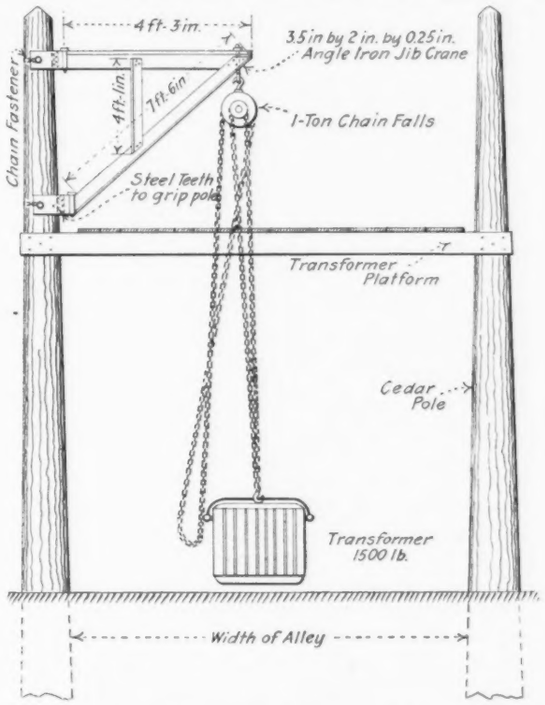
PUBLIC UTILITIES REPORTS ANNOTATED. Decisions of the Public Service Commission and of State and Federal Courts. Rochester, N. Y.: Lawyers' Co-operative Publishing Company. Annual subscription, $5 per volume; single advance parts, $1 each.

Nos. 1 and 2 of these reports, dated respectively Feb. 18 and March 4, have appeared. No. 1 contains 128 pages; No. 2, 254 pages. The advance sheets published fortnightly in this form will be followed by bound volumes on law India paper, to be published as sufficient matter accumulates in advance sheets. The purpose of the publication was set forth in the issues of the ELECTRICAL WORLD for Dec. 5, 1914, and Jan. 30, 1915. The series began with cases decided after Jan. 1, 1915. Editorial preparation of the reports is in the hands of the publishers' permanent staff, in special charge of Mr. Henry C. Spurr. The publishers also acknowledge the services of Mr. A. S. Hills, formerly in charge of the bureau of commission research of the legal department of the American Telephone & Telegraph Company, and of Messrs. Smith, Knowlton & Hatch, attorneys, Colorado Springs, Col. The wide and valuable scope of the work is shown by the fact that cases in the first numbers relate to gas, telephone, water, steam-railway, electric and electric-railway utilities. The publication gives utility officials promptly the complete text of all leading decisions in this field of jurisprudence. A series of this kind has been needed. Accurate knowledge of all higher court and commission decisions on regulation is indispensable for all utilities.

POWER AND OPERATING SECTION

Jib Crane a Help to Handling Transformers

When the construction crew or the repairmen of the Crawfordsville (Ind.) Light & Power Company have to hoist a large and heavy transformer to an alley platform, use is made of a jib crane and chain falls to lighten the task. The crane itself, which is home-made, consists of six pieces of 3.5-in. by 2-in. by 0.25-in. angle iron riveted together to form the jib, and two pole


4 ft. 3 in.
3.5 in by 2 in. by 0.25 in. Angle Iron Jib Crane
Chain Fastener
4 ft. 1 in.
7 ft. 6 in.
1-Ton Chain Falls
Steel Teeth to grip pole
Transformer Platform
Cedar Pole
Transformer 1500 lb.
Width of Alley

HOISTING HEAVY TRANSFORMER TO ALLEY PLATFORM

grips equipped with chain and turnbuckle fasteners. The inner side of these grips is plentifully studded with projecting points of steel, so that when once the jib is in place it cannot slide down the pole. The crane weighs about 250 lb. and, excepting the chain falls, costs about $10. In lifting a 1200-lb. or 1500-lb. transformer to a platform the time and human energy saved on one job will almost pay for the jib. Mr. F. H. Miller, manager of the Crawfordsville company, said the fact that the jib saved the trouble of emptying oil from transformers made it more than worth its cost. The principal dimensions of the crane are given in the accompanying drawing.

Extra Costs of Continuous Operation

Some costs of continuous operation were given recently in a case affecting the Illinois Northern Utilities Company which was tried before the Railroad Commission of Wisconsin. In this case residents of Walworth, having a population of 900, and of Fontana, population 200, asked a more extended service.

It was testified on behalf of the company that the operating force of the Walworth plant consists of two engineers, two firemen and a coal wielder, who worked in two shifts. Lighting service was furnished in the two communities from 7 a. m. to 12 p. m. To provide continuous service would require an additional engineer, an additional fireman and an increase of about 25 per cent in the monthly coal bill, which ranged from $515 to $950. Summer business is greater than winter business owing to lake resorts in the vicinity. The plan of the company to build a transmission line from a larger plant to Walworth and Fontana, and eventually to close the Walworth plant, would involve construction of about 20 miles of high-tension line at a cost of approximately $35,000 but would permit continuous service. Probably this line will be built during the coming summer, although this has not been decided definitely. The commission ordered the company to furnish service between 5 a. m. and midnight in the meanwhile.

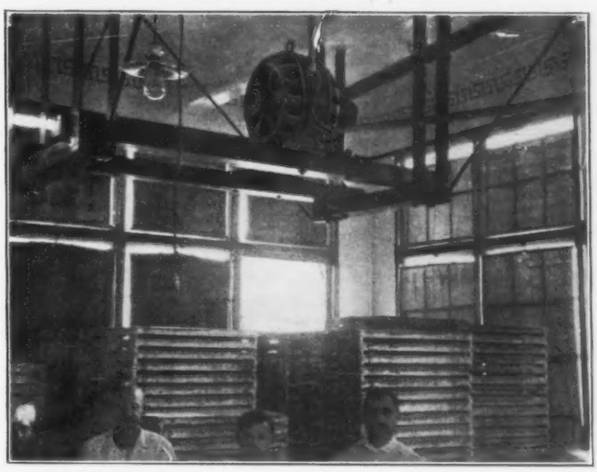
Electric Drive in Confectionery Making

One of the most thoroughly equipped factories in New England for the manufacture of candies is that of Page & Shaw, Inc., at Cambridge, Mass. The product of this company is widely known throughout the country. A factory building of five stories is used exclusively, and though provided with a steam boiler plant for heating, and for the heating of candy kettles, central-station electric drive is employed for all the processes of manufacture.

Energy is obtained from the Cambridge Electric Light Company, 550-volt alternating current for the operation of motors and 110-volt direct current for lighting, mostly with 60-watt and 40-watt tungsten lamps.

Beginning at the ground floor, two 15-hp induction motors operate two 8-ton Brunswick compressors for refrigeration by the brine system, this equipment being in duplicate. Cooling pipes are carried through the dipping and packing rooms on the floors above.

The candy machines are manufactured mostly by the National Equipment Company, Springfield, Mass. A 15-hp motor drives what is known as a "mogul," consisting of a depositor, starch buck and printer, for producing caramel centers. Connected by belts to overhead shafting are a cream melter, a marshmallow beater, cream cooler, Werner beater, and a Taber rotary pump



MOTOR-DRIVEN "MOGUL" CANDY MACHINE

for conveying liquid materials from a boiling kettle to the cooler.

The milling and mixing room contains a chocolate refiner, a chocolate melting kettle and a shaking table, all operated, as to their moving parts, by a 15-hp induction motor, through overhead shafts. A 3-hp motor drives three chocolate-dipping machines. In this department

there is installed a 5-hp motor belted to a 1-ton Brunswick refrigerating machine. This apparatus is for cooling storage cabinets directly over dipping tables, by the direct-expansion system.

In an adjoining room a 10-hp motor drives a group of machines, consisting of a cream beater, two sizing machines, egg beater, nougat cutter, almond blancher, and the stirring apparatus in a caramel kettle and a nougat kettle. Here, as elsewhere in the factory, small blowers operated on the 110-volt service provide forced draft to the gas stoves for kettle heating.

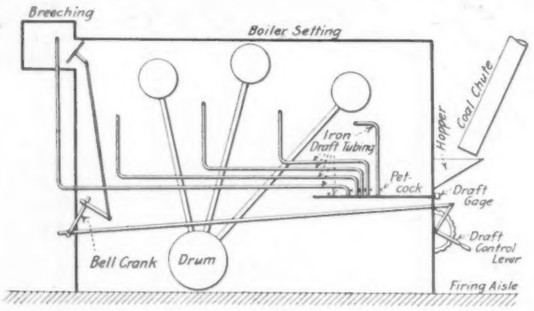
A machine for molding hard candies is operated by a 1-hp motor installed under the machine. One 14-in. and one 16-in., 110-volt fan are installed at the head of two tables, for cooling candies.

The factory contains a complete box-making and label-printing department. Here is installed a cylinder press, driven by a 3-hp motor; and three job presses, a power cutter, box-dyeing machines, scorers and box-staying machines are operated from overhead shafts by a 5-hp motor, supported on a platform suspended from the concrete ceiling beams by hangers of 3-in. strap iron. This type of mounting is common to all motors not on the floor, as noted.

A 3-ton Otis elevator serves the five floors. This is operated by a 20-hp motor. The aggregate horse-power in motors is 112, and the monthly energy consumption ranges from 3000 to 13,000 kw-hr. with varying seasons. The nature of the business calls for a wide range of activity, the briskest part of the year being the weeks preceding Christmas, when the factory runs nights as well as days. At this time the motors are operated almost continuously, while the lighting load is likewise at its maximum. The yearly bill is approximately $2,500, the rate being the Cambridge company's wholesale rate, averaging about 2 cents per kw-hr.

Damper Control and Draft Gage Side by Side

At the front of the boiler, within easy sight and reach of firemen walking in the firing aisle, is the proper place for the draft gage and the lever for damper control, according to Mr. M. L. Addington, chief engineer for the Merchants' Heat & Light Company, Indianapolis, Ind. In this company's main generating station twelve 500-hp and four 610-hp Stirling boilers, equipped with Roney stokers, have been equipped with a comprehensive draft-gaging outfit and draft-control apparatus, mounted at the side of the stoker hoppers. Several dif-

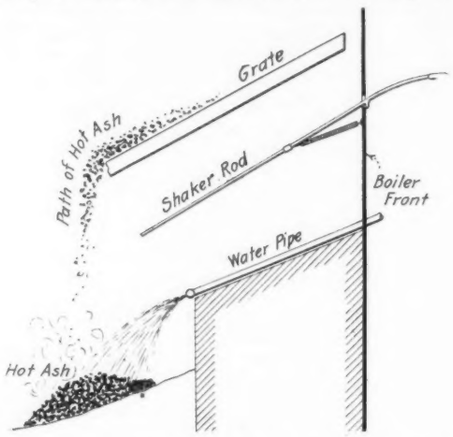


DRAFT GAGE AND DRAFT CONTROL AT FRONT OF BOILER SETTING

ferent grades of Indiana slack coal are burned in these furnaces, and the various draft tubes, opening into six different parts of the boiler setting, allow the firemen to read separately the draft at any point and, if necessary, to change the damper position to suit the draft conditions to the character of the fuel. By having the draft gage and the damper lever side by side the firemen can adjust conditions accurately and quickly and assure economical combustion under the boilers, which operate at from 75 per cent to 100 per cent overload every day.

Water-Pipe System Cools Ash and Breaks Clinkers

Under the Roney stokers which feed coal to the furnaces of an Indiana power house a piping system has been installed so that jets of water may be directed upon the pile of hot ash and cinders falling from the



WATER-PIPE SYSTEM FOR COOLING ASH AND BREAKING CLINKERS

rear grate bars. Seen in cross-section, one of these furnaces with its auxiliary piping would appear somewhat as in the accompanying sketch. At both sides of the air chamber beneath the grate the water pipe extends backward and downward and runs along the edge of the ash pit at the rear of this chamber. That portion of the pipe along the edge of the ash pit is perforated at short intervals on a line facing the rear wall of the pit, and when water is turned into the line by means of a valve on the furnace front a line of water jets springs from the perforations and plays upon the hot material in the pit. With the boilers operating at full-load rating these tiny streams of water are allowed to run continuously, thereby cooling the ash and breaking up any clinkers which may form from the Indiana slack coal.

Roof Replacement in Superior, Wis.

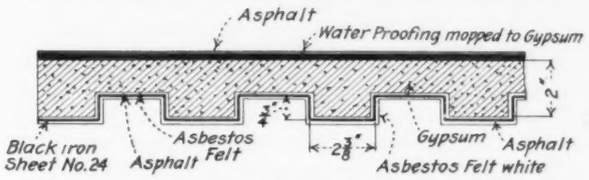
The Superior (Wis.) Water, Light & Power Company has recently replaced an old wood roof over its engine and generator room by a fireproof roof.

The generator room is 100 ft. by 73 ft. and was covered by a roof of 2-in. wood sheathing with waterproof covering supported from five steel trusses and carrying a monitor over 70 ft. of its length. The roof is of deck construction, the deck part having a slope of only ½ in. to the foot and the sides having a slope of 45 deg.

The steel trusses are of flat-top type with 45 deg. end members, and the old roof was carried on 6-in. by 10-in. wooden purlins, which, in the case of the deck part of the construction, rested on wooden sills laid along the top of the trusses and cut to the slope of the deck roof.

It was necessary to make the change of roof while the plant was in operation, and it was evident that it would be highly advantageous to carry the new roof on the old trusses, which are in good physical condition. In connection with their design of the new roof the consulting engineers of the company, Messrs. D. C. & Wm. B. Jackson, of Chicago and Boston, developed the fact that the trusses showed a very close factor of safety for

the weight of roof and monitor that had been installed originally, and it was therefore found that a new roof of little if any greater weight than the old roof would necessarily have to be installed in case the old trusses were to be used. This condition removed from consideration any of the heavier roofs, such as concrete slab, heavy tile construction, etc., and the small slope of



CROSS-SECTION OF SLAB ON DECK OF ROOF

the deck portion of the roof ruled out the use of slate and other types of roofing not having waterproof joints.

The engineers found that an effective and satisfactory roof could be installed, comprising for the steep slope part of the roof and for the roofing over the monitor the Asbestos Protected Metal Company's corrugated protected metal roofing, and for the deck portion of the roof the same company's "asbestosteel" roofing, having a covering of a maximum thickness of 2 in. of gypsum plaster topped by Carey waterproof covering. This gives a thoroughly fireproof roof with a weight of only about 8 lb. per square foot, a weight much below the usual types of fireproof roofing and very little heavier than the old roof. It was also found practicable to add certain reinforcing members to the trusses, which gives them an ample factor of safety.

As the old roof was carried on 6-in. by 10-in. wood purlins, it was possible to design the new roof so that the old wood sills carrying the purlins could be replaced by specially designed steel sills and so that the new 6-in. steel purlins could be put in place ready to receive the new roofing before the old roof was removed.

The work of reinforcing the trusses, putting in the steel purlins and installing the new steel monitor with wire-glass swinging monitor windows, and the removal of the old roof, was done under the supervision of the superintendent of the electric company in accordance with the plans of the engineers, and the placing of the new roofing was done under contract with the Asbestos Protected Metal Company. Although the removal and replacement were effected in October and November, while the plant was in regular operation, no serious difficulties were encountered, and the new roof is proving in every way as effective and desirable as the company's engineers had expected it would be. Although during the reconstruction there were several days of bad weather with rain and a little sleet, no damage or interruption to operation was entailed.

In the roofing the main difference between the new construction and the usual practice of the Asbestos Protected Metal Company is in the use of gypsum plaster instead of cement plaster in covering the deck portion of the roof. This gives an additional factor of lightness which is well worth obtaining under such conditions as those existing at the Superior plant. Mr. William H. Winslow is vice-president and general manager of the Superior company, and Mr. P. C. Miller is the superintendent.

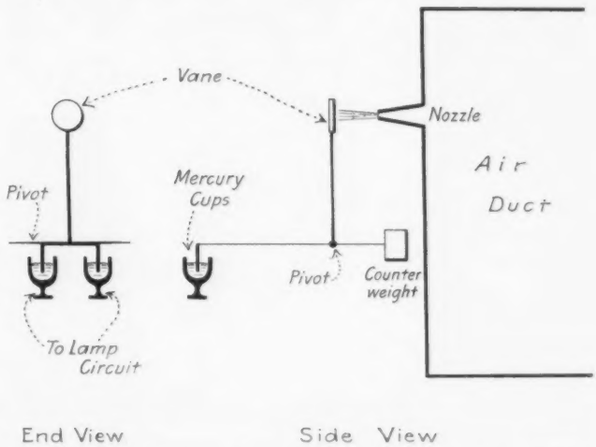
Indicating Number of Boilers to Be Operated

No matter how efficient boilers are, they cannot be operated economically if several are allowed to supply less steam than they are rated for. The correct practice is to operate only enough boilers so that each will be supplying not less than its rated amount of steam, while the others have their fires banked for emergency loads or approaching peaks. At the generating station of the United Electric Light & Power Company, New York City, the boiler-room attendants are notified by a carriage-call signal of the number of boilers which should be operated. The use of a carriage-call signal in boiler rooms is not new, but the operating mechanism and the records it furnishes are interesting.

The operating mechanism is placed in the switching room as the attendants there can ordinarily tell in advance what the load will be and consequently the most economical number of boilers to be operated. The mechanism is provided with two time stamps, one of which records the time that any signal is sent to the boiler room while the other stamps the time at which the boiler-room attendant recognizes the instructions. The connections operating the carriage-call signal and indicating the number of boilers to be operated are made by inserting specially perforated fiber strips and pressing down a handle which forces contactor pins through the holes in the strip. This operation also starts a whistle blowing in the fireroom and allows it to continue until the signal is acknowledged. The use of a tape allows the strips to be used over and over again so that they can be made of fiber instead of the less durable cardboard. The record tapes taken from this instrument are compared with the boiler-room log sheet to see that the orders of the switchboard operator have been complied with.

Pilot Lamp Indicating Generator Ventilation

If the current of cooling air through turbine-driven generators is interrupted even for a short time, the units will heat up considerably. Positive indication of pressure in each generator air-supply duct is afforded at the generating station of the United Electric Light & Power Company, New York City, by employing pilot lamps which are extinguished if the air pressure in the ducts is interrupted. The accompanying illustration shows how this switch operates. When air is being supplied to a generator enough will be discharged through the nozzle shown to keep the switch in the closed position. If the air pressure drops, however, the weight attached to the switch will open it and ex-



MECHANISM CONTROLLING AIR-SUPPLY PILOT LAMP

tinguish the pilot lamp, which the switch controls. Contact is made at the switch by one end dipping in a receptacle containing mercury. This switch does not have to be set by hand as restoration of air pressure in the duct will close the switch automatically. The pilot lamps are installed on the machine panels on the control board, in full view of the station operator.

Brick-Plant Production Increased by Electric Drive

The advantage of electric over steam drive has been demonstrated in a practical manner at the plant of the Springfield (Ill.) Paving Brick Company, where the output has been increased about 35,000 to 50,000 bricks per day. When operating with steam it was necessary to shut down the entire plant if anything happened to the

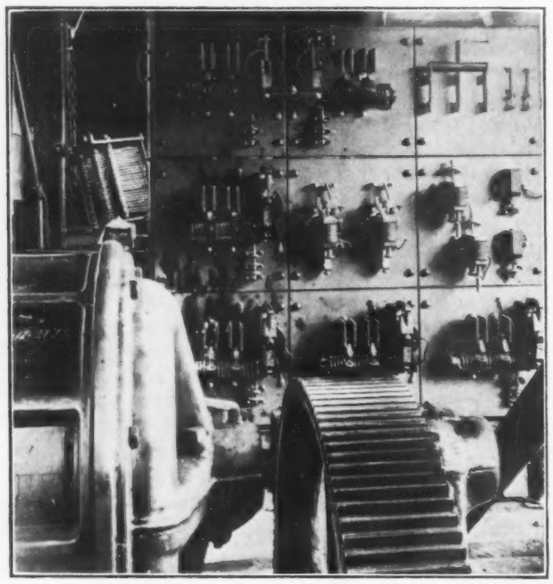


FIG. 1—CONTROL EQUIPMENT FOR CLAY SHOVEL

engine. With individual drive, made economically possible by using electric motors, such delays have been eliminated. Moreover, the new equipment possesses another advantage—that of simpler control. In addition, energy is required only when useful work is being done.

Sixteen motors with an aggregate rating of about 600 hp are installed with the accompanying auxiliary ap-

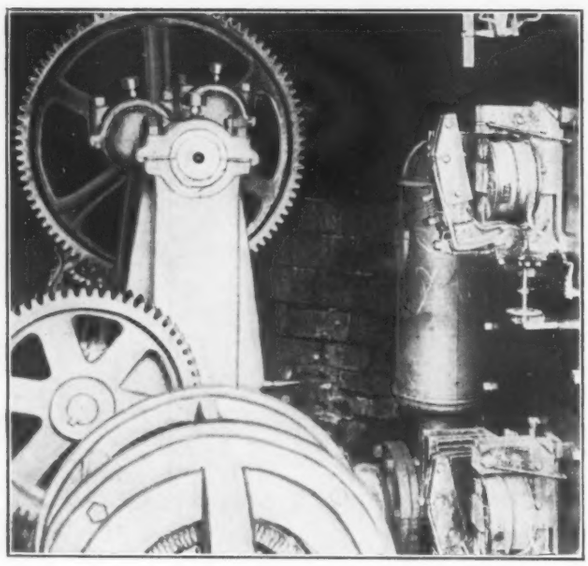


FIG. 2—MOTOR OPERATING DRYING PANS

paratus and machines. Everything from the digging of clay and sump pumping to loading of finished bricks is performed by electricity.

Prior to the installation of the present equipment the plant had a daily output of 75,000 bricks per day. Now the average daily production is 110,000 bricks. The maximum quantity is 160,000 bricks in a nine-hour day.

Energy is supplied to the plant over a direct line at 6600 volts and is stepped down to 440 volts by three large transformers. Two motors rated at 52 hp and 37 hp respectively operate the clay shovel, which is controlled as to the size of the "bite," etc., from a specially designed switchboard. A motor-driven rotary pump removes water from the clay pit while excavating is being carried on.

A 35-hp motor operates a cable conveying cars loaded with clay from the pit to the tipple of the plant 57 ft. above. At the top the clay is automatically dumped into drying pans which are agitated by two 50-hp motors and one 40-hp unit. When the moisture is removed from the mass the powdered shale is sifted out and the coarse particles returned to the pans for further grinding.

Water is mixed with the pulverized clay in a "pug" mill operated by a 45-hp motor. The plastic mass is then delivered to the hopper of the molding machine, from which the mixture is fed to the dies by a large spiral worm. This machine requires more power than any other in the plant, being operated by a 150-hp motor.

The molded clay as it emerges from the dies is fed onto an endless-belt conveyor which delivers the bar of plastic clay to the cutter. The "green" bricks are loaded onto cars and transferred to a drying oven, where they

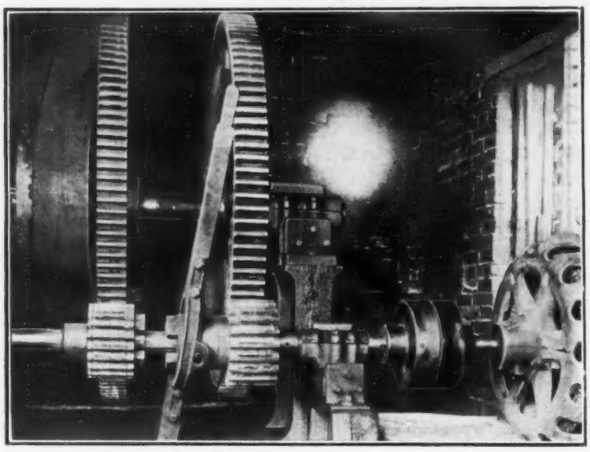


FIG. 3—40-HP MOTOR OPERATING DRYING FAN

are allowed to remain for twenty-four hours. The oven, which measures 150 ft. wide by 300 ft. long, is heated by waste gases from the kilns. A 40-hp motor-driven blower circulates the air through the drying oven.

From the drying room the cars loaded with brick can be transferred to any part of the plant or kilns by a traction conveyor. The traction system is operated with 220-volt direct-current energy furnished by a motor-generator set.

Coal for heating the kilns is brought to the plant from a neighboring mine over an elevated railway. To facilitate distributing the coal the elevated tracks are extended over the kilns. Although an attendant rides on each train of cars, they are operated from control stations installed every 20 ft. along the track. Three-button push switches permit of starting, stopping and reversing the motion of the train. A guide wire stretched along the entire track furnishes means of stopping the cars in emergencies between stations. The plant is lighted from a circuit distinct from that feeding motors. Tungsten-filament lamps rated at 200 watts are used.

The equipment at this plant was installed under the direction of the engineers of the Springfield (Ill.) Gas & Electric Company, a Hodenpyl-Hardy property, and Mr. E. I. Weaver, general commercial engineer connected with that company.

COMMERCIAL SECTION

Reducing the Jobber's Losses

IT is computed that all jobbers suffer loss on from 5 per cent to 10 per cent of their stock which is rendered obsolete each year because electrical manufacturers are constantly making changes in their products without notifying jobbers of the intended changes before the new products are placed on the market. The advertising activity of the manufacturers creates immediate widespread demand for the new product, whereupon the old and superseded product, if salable at all, must be disposed of at a considerable loss to the jobber. Much of this waste could be eliminated if the manufacturer would give the jobber a longer advance notice of intended changes in the line. The jobber then would have time to get rid of old material and would be prepared to lay in a large stock of the new product. He would suffer only a slight loss through the changes made.

Appliance Sales Profits

THE merchandising of electrical appliances has ceased to be a game of wits and has become a stable and substantial business. The old question of whether a company should sell appliances at a fair profit or sell them without profit, or even at a loss, in order to derive the benefits of an increased load, has been answered by many companies in the fixing of a definite profit margin for all merchandising. For it has been found that the load added by too alluring bargain sales is not always of a desired character. It is not a load that will automatically increase, but rather it is liable to dwindle materially because too often it was the price and not the attendant advantages that prompted the purchase. On the other hand, when a device is sold at a fair profit the purchaser as a rule knows the value of the article and, if satisfied, will become a regular customer. This load automatically increases through the purchase of additional appliances, and since each article was purchased because of its inherent qualities, its energy consumption will be regular and definite.

Employees as Appliance Users

TOO many employees of electrical companies are unfamiliar through personal experience with the convenience of electric appliances, their low cost of operation with careful use, and their superiority over other devices for small mechanical and heating applications around the home. It should go without saying that every central station will furnish its staff with electrical devices at rock-bottom cost, and many companies might well go farther than this in connection with special campaigns. The methods by which such service can be developed will vary in different places, but there is no escaping the value of the employee's personal testimony as a satisfied—or, better, as an enthusiastic—user of electrical conveniences. To consider a single field, the electric range offers a wonderful opportunity for the acquisition of practical data by its use in the homes of employees competent to gage its fitness for various kinds of service, to learn by handling it the most economical method of operation, and to assemble actual costs of specific meals and culinary items, so often indefinitely understood. Nothing convinces prospective users like personal testimony, and in such a field as electric cooking it pays to go to some expense and trouble, if need be, to gather in the facts to be used later by the salesmen. Not every employee, of course, can be expected to afford the company proper material for trial services; but there is here an opportunity which can be developed from small beginnings with trial installations into most useful results.

Window Display

THE value of a window display lies in its power not only to attract the passers-by but to convert them to customers. Windows filled with a sample of everything in stock, such as the ordinary contractor's window, attract only dirt and flies. On the other hand, a too attractive window will keep outside the people who might have been induced to enter the store with a less attractive display. The best display is one which first attracts the people and then, having aroused their curiosity, leads them inside to become buyers.

Where the Electrical Contractor Sees an Injustice

DISCUSSIONS in closed sessions at electrical contractors' conventions show that some contractors and dealers believe themselves unfairly treated by local lighting companies, because the monthly bills rendered by the company for energy—which is used chiefly for demonstrating heating appliances and for long-hour display lighting—consume a large part of the profits of the dealer's business. Before the advent of public-service commissions some electrical dealers and contractors enjoyed rates which allowed them to use electrical energy more freely in promoting the sale of electrical merchandise, because the broader-minded company executives properly believed that the advertising value of the dealer's display and the resultant increase in connected load justified a low rate to the progressive dealer. Now, however, being considered discriminatory, this practice has been generally abolished, and the contractor's shop with its extraordinarily heavy connected load has been placed on the same rate schedule with its

neighbors. As the result, such a shop now furnishes two or three times the revenue to the lighting company that it did formerly.

A few contractors have urged a change in commission rulings to allow electrical dealers lower rates for service. Others have sought for loopholes in existing legislation. But such recourse is in many cases quite unnecessary if the alternative adopted with success in several cities is followed. In the places referred to almost every local electrical contractor's shop window bears a painted sign advertising the service of the lighting company. The lighting company pays the contractor for this publicity at the rate it is worth as advertising space. This is most valuable publicity for the company. On the other hand, the presence of the sign is of real value to the contractor, and the income he derives from it helps offset, of course, the outlay for electricity necessary to display his wares. This is but one of the many co-operative plans by means of which the contractors and the utility companies can be of mutual benefit, if one will only take the initiative and tell his troubles to the other.

Lighting the San Diego Exposition

Each exposition presents its own peculiar features as a lighting problem, depending on the environment and the architectural effects undertaken. The illumination of the Panama-California Exposition at San Diego, described in the current issue, is admirably adapted to the requirements of this particular case. One cannot attempt within modest dimensions and at feasible expense the huge decorative effects that characterize, for example, the Panama-Pacific International Exposition, while it is quite possible to secure very striking lighting extremely well suited to its surroundings, as seems to have been done in this instance. The exposition at San Diego follows architecturally the old Spanish precedents, which have indeed had their salutary influence on the larger exposition at San Francisco; but San Diego is peculiarly an appropriate center for the Mission influence. Lying as it does close to the Mexican border, it comes nearer to a semi-tropical environment than any other American city.

The lighting of the Exposition, as our readers will see, is carried out in a graceful and dignified way through the Exposition grounds, without any attempt at outlining the chief buildings with lamps, such exterior illumination being used, when at all, with great restraint. The main lighting is done with tungsten lamps, in diffusing globes, so arranged as to throw soft and well-distributed light over all the surroundings. Decorative lamp-posts of staff, closely spaced and alternating with black acacia trees, are used on the principal avenues and plazas of the Exposition grounds. Elsewhere less elaborate wooden posts painted in old bronze and surmounted by diffusing globes are employed. In the arcades along the streets use is made of an interesting form of indirect lighting by means of plaster fixtures with interiors enameled directly on the plaster, each containing four 25-watt tungsten lamps. The arcade ceilings are lightly tinted to gain the necessary amount of soft reflection. The general effect is one of artistic dignity quite free from glaring pretentiousness.

The Contractor and the Household-Supply Business

A prominent electrical supply jobber recently made the statement that unless the electrical contractor soon realizes the value of a household-supply business conducted along sound merchandising lines, this desirable source of business is likely to pass out of the hands of the electrical profession. This statement is worthy of the very serious and immediate attention of all electrical contractors. For the merchandising of electrical appliances to the home is rapidly being assumed by hardware stores, drug stores and department stores, with sales in some cases greatly exceeding those of the retail electric stores themselves.

Although the public would naturally be expected to prefer to buy electrical appliances from a firm engaged strictly in the electrical business, the reason for the growing sale of electrical material by other agencies is not hard to find. The cause is not a matter of price, as many suppose, but rather the fact that the hardware, drug and department stores avail themselves of all the good influence of modern merchandising methods, while the electrical dealer in many cases does not. The mere possession of a store and some one to attend to customers is far from being all that the public desires and the opportunity demands. Trade automatically flows to the attractive, well-arranged and well-lighted store where good service is a conspicuous and pleasing feature. Many electrical stores to-day can hardly be called inviting. The service is poor. The display of goods is far below the standard of the other stores the public is accustomed to. A workman with dirty hands comes out from the shop to wait on customers, or the over-busy contractor himself attempts to drop his other and more pressing interests and be the salesman in emergencies. The atmosphere of the store is wrong.

The retail electrical business, the merchandising of household supplies, is an opportunity well worthy of a serious effort by the electrical contractor. It possesses far less commercial hazard and fewer uncertain features than does the electrical contracting business itself. It is continuous and cumulative in its development, if well conducted, and yields a generous, steady profit. It offers an opportunity for building up a renewal business from regular customers that is of particular value. The contractor who enters this field must watch and keep in mind the merchandising methods of other merchants, and follow to a considerable extent the guidance of the well-established stores. He must apply the standard practice that has been evolved by generations of successful merchants, in his advertising and in his credit and his delivery methods as well as in his selling policies. And if he does, the time is likely to come when his retail store will be the most dependable and promising feature of his enterprise.

Contractors' Cost-Keeping System

Convenient and Efficacious Means Adopted by Electrical Contractors for Checking Estimates Against Material and Labor

SUCCESS in any business is largely dependent upon the promoter's intimate knowledge of underlying details. The successful electrical contractor, like most business men, is too busy personally to supervise all the details of his business, but it is possible for him to so organize his business and to so systematize its various details as to bring to his own attention and to the attention of his subordinates all errors and deficiencies. When a business is thus organized its success is practically assured, for the knowledge of one's shortcomings may be said to be one of the most important steps on the road to success.

The estimating and cost-keeping system employed by the George Weiderman Electric Company, of New York and Brooklyn, is so devised that it permits the estimator to check his material and labor estimates constantly with the actual material and labor required. In addition, it also tends to cause each electrician to put in an honest day's work and permits errors and differences to be readily detected and rectified. The system does not entail a great amount of labor for its successful operation.

The accompanying illustrations show the various forms employed. The form shown in Fig. 1 is printed on the face of a 6¼-in. by 9½-in. manila envelope. The other forms are all of such size as to permit them to be inserted in the envelope without folding, except the estimate sheets, which are folded once.

Estimate Sheets

Figs. 3 and 4 show the two sides of an estimate sheet when in the unfolded condition. The left-hand column of each page of the estimate sheet, it will be noticed, is devoted to a list of the materials commonly required, the list being carried over from page to page. Underneath the various reminders the estimator places the amount of such materials as he estimates will be required. For example, in the case under consideration the estimator estimated that 400 ft. of ½-in. conduit would be required. In another column the estimated cost of such material is entered, and in still another column the estimated labor required for installing it. In the case of the conduit these estimates are respectively $10.14 and $20. The estimated cost of labor and material is totalized on each page and the amount carried over to the next page, the grand total being drawn on the fourth or last page.

In the narrow columns to the left of the column devoted to the estimated cost of the various materials listed are entered the amounts and costs of the materials taken to a job from time to time as shown by the material vouchers taken out by the men performing the work. When material is returned, its amount and value are entered in red ink in these columns. To the extreme right of each page a column is provided for the actual cost of the various materials installed.

It is thus seen that the estimator can readily check his estimates with the actual material and labor required. In this way his errors are called to his attention, and in making future estimates he can guard against repeating such errors. Moreover, this estimate sheet shows at a glance any case in which more material than estimated has been sent to a job. When such a condition exists it is, of course, immediately investigated. The material actually used will then be checked and any loss or waste of material learned. If no loss or waste has occurred, the estimator's attention is called immediately to the deficiency in his estimate.

Material and Time Vouchers

Fig. 8 shows the form of material voucher employed. It will be noticed that the actual costs of materials are entered on the voucher and any incidental charges for the handling of the same. A space is also provided for the electricians and helpers, to give their hours of service and expenses. These vouchers are taken from pads in which they and the stockman's copies are arranged in numerical order.

Fig. 9 is a reproduction of the daily time vouchers of the workmen. It will be noticed that instructions are given to the effect that a complete, detailed account of work done must be made out and that the slip must be sent to the office at the close of each day. On the back of the vouchers spaces are provided for giving the amounts and sizes of various materials installed. Space is also provided for a list of materials needed. These

FIGS. 1 AND 2—CONTAINING ENVELOPE AND WAGE RECEIPT

time slips are turned in daily together with whatever material vouchers may have been obtained the same day. The labor vouchers are, of course, employed for computing the workmen's pay at the end of each week and for making the proper charges.

Fig. 5 shows a weekly time voucher which the men are required to send in every Thursday night. These weekly vouchers are employed in order to permit the bookkeeper to check his payroll. When the workmen receive their wages they are required to sign a form such as is illustrated in Fig. 2. In this way no differences

over wages and expenses between the company and its men can occur at some future time.

Fig. 6 shows a form which the superintendent fills out on his visits to the various jobs under way and hands in to the office every day. The superintendent retains a carbon copy of the reports, and is hence able to tell at a glance the progress made in the work. These reports serve to check up the reports of the workmen and also to show how closely the superintendent keeps in touch with the work under way. The estimated labor required and the labor to date are also entered on these reports.

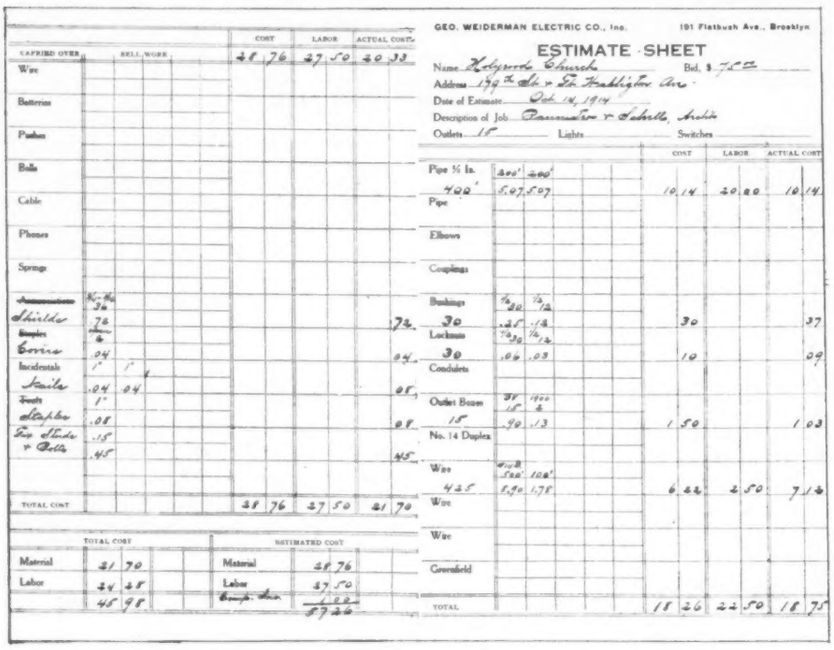


FIG. 3—LAST AND FIRST PAGES OF ESTIMATE SHEET

It will be noticed that the weekly time vouchers of the men and the report forms for the superintendent are all provided with spaces for the workmen or the superintendent to give their addresses. In this way the firm is able to learn of any changes in the addresses of its employees, a consideration that is valuable at times when the firm must get into contact with its men in the minimum amount of time.

Contract Envelopes

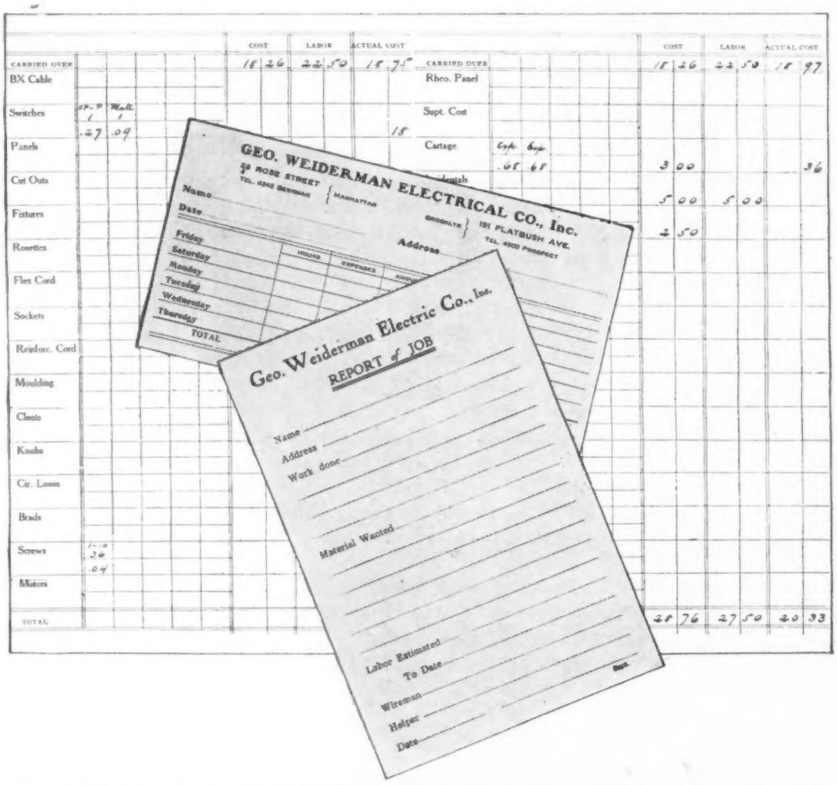
Fig. 1 shows a reproduction of the form printed on the outside of the envelopes in which the other forms are filed. All of these envelopes are numbered as indicated. A complete description of the work undertaken, contract price, terms, etc., is given. Space is also provided in which the bookkeeper records from day to day the cost of the labor and material for the corresponding job. A column is provided for entering credits for any material returned. The labor, material and credit charges are obtained from the daily time and material vouchers of the men.

Practically the same form is used for material returned as for material taken out. The form employed for returned material is printed on pink paper with the heading "Credit Slip," the remainder of the form being the same as shown in Fig. 8. The labor and material totals as found on the front of the envelopes are added, and all credit for materials returned is subtracted from this total, thus giving the total cost of an installation when completed. This total cost is also entered on the estimate sheet and compared with the estimated cost.

Contract-Record Forms

Fig. 7 shows the contract-record form employed. A contract book is maintained and the original of these forms retained in the book. Every alternate page of the book is of yellow paper and is designed for the purpose of making carbon copies which can be torn from the book. These carbon copies are filed with the other forms in the envelope for the corresponding job, thus guarding against possible loss of the originals.

It will be noticed that a complete description of the work to be performed, the location of the building in which the work is to be done, charging directions, estimated cost, terms, number of the contract envelope, date of billing and the ledger number, together with the date and the necessary signature, are given.



FIGS. 4, 5 AND 6—INSIDE PAGES OF ESTIMATE SHEET, WEEKLY TIME VOUCHER AND JOB REPORT BLANK

These contract-record forms are made out in duplicate, as has been described before, as soon as work for which a contract has been awarded to the firm is actually undertaken.

The advantages of this system of keeping the details of every contract are obvious. At the most it takes the bookkeepers only three days to enter any material or labor charge, and hence the state of the work at any time can be learned immediately with comparatively great accuracy.

As the estimator has all the variations in the amount of material and labor estimated from the actual amount of material and labor required brought to his attention, he can guard against repeating previous errors. Moreover, a constant check can also be maintained on the performance of the workmen. The foremen will detect and investigate any apparent deficiency in the performance of the men under them. The workmen, knowing that their performances as entered on their time slips are seen by their superiors, naturally aim to maintain as good a showing as possible, with the immediate desire to hold their jobs and the remote ambition to sometime themselves have the opportunity to investigate the performance records.

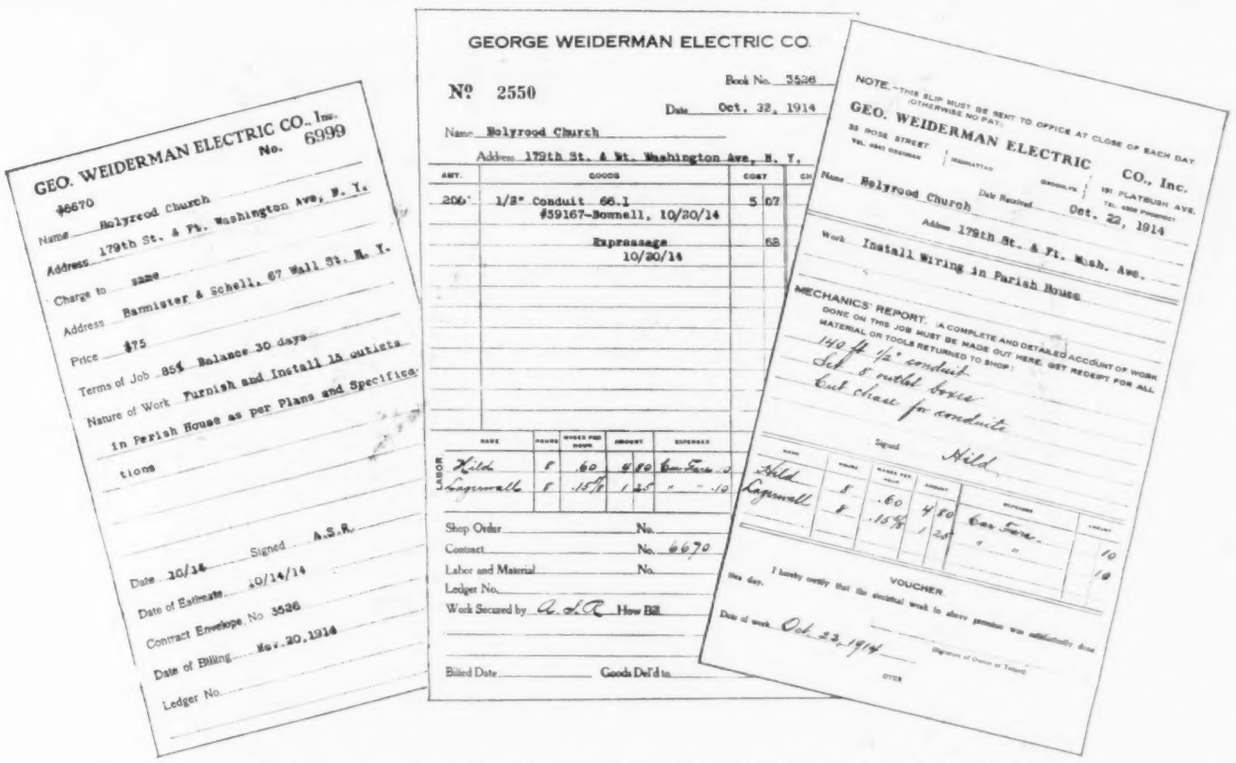
The entering of all material and labor charges on the forms employed is advantageous in that it not only shows the accuracy of the material and labor estimates but it also shows any loss or waste of material. The envelopes are all placed in a file, and upon the exterior of each envelope a general idea of the nature of the contract is given. All material, labor and credit deductions are entered on the face of the envelope as previously described. When a contract is completed the corresponding envelope is stamped "Billed" and the date of billing given. A rubber stamp reading "Profit Recorded" is also employed for stamping the envelopes as soon as the profits are recorded. The usual bookkeeping ledgers are, of course, maintained, the ledgers being numbered. The envelopes are filed according to contract numbers and are retained in the files permanently. If at any time an envelope for any contract is desired it can be located by means of a card index giving the contract numbers corresponding to those stamped on the various contracts.

The "White Way" a Help to Salesmen

The installation of a "white way" in any city is considered good business for the central station inasmuch as it means the installation of extra lamps of the standard type along the business thoroughfare or the adoption of a more or less spectacular system such as the high-intensity magnetite lamps, the flame lamp or the gas-filled tungsten. Any or all of these systems usually mean an increased revenue from street-lighting service.

There is, however, another source of revenue to the central station brought about by the installation of a "white way," and that source is through the desire of the merchants to "look their part."

Jersey City, N. J., has enjoyed a "white way" in the down-town section for some time, the installation being of the 6.6-amp inverted magnetite arc on ornamental standards. Early in December, 1914, the up-town section of Newark Avenue, the main business street, was lighted in a similar manner.



FIRS. 7, 8 AND 9—CONTRACT RECORD FORM, MATERIAL AND DAILY TIME VOUCHERS

The Public Service Electric Company of Jersey City, N. J., realizing the advantage of a "white way" as a salesman, has collected the following data as the result of the second installation. All of the following improvements or additions were made prior to the turning on of the "white-way" lamps, and since that time many stores have put in new fronts with modern lighting and there will also be erected before the next holiday season several electric signs of the better class: Stores in which permanent additional lighting equipment was installed, 7; windows which were altered and additional lamps installed, 5; windows in which modern lighting was installed with no additional load, 3; installations of "front lamps," ranging from 200 watts to 1000 watts, all additional to existing installations, 9.

This additional business, however, did not come without hard work. The salesman in that particular district spent nearly six months working up the merchants to the point of appreciating that a "white way" is not a "white way" without "white stores."

Electric-Heating Appliance Salesroom

Description of Display, Stock and Shipping Rooms and Outline of Merchandising Methods

ROGER WILLIAMS, New York agent for the Simplex Electric Heating Company, Cambridge, Mass., who has recently moved to 120 West Thirty-second Street, New York City, has one of the most attractive electric-appliance display rooms in that city. Adjoining it are the receiving and packing room, the repair shop, the stockroom and the business departments, all of the space being on the third floor. Street-level space was not chosen, as Mr. Williams has found by past experience that when handling only one manufacturer's products a dealer is liable to be bothered by persons asking for something that is not kept, such as flashlamps, electric bells, etc., whereas those intent upon having one brand of article are almost certain to seek the headquarters of the local agent.

FIG. 1—INTERIOR OF ELECTRIC-HEATING-APPLIANCE DISPLAY ROOM

Display Room

The display room, which is attractively furnished with silvered-oak wall cabinets and a demonstration table, can be seen in its entirety from the third-floor corridor through a plate-glass wall. The cabinets are sunk in the walls so their faces are flush therewith. This arrangement eliminates the bulky appearance which other types of wall cabinet have. No table appliance is set on a table or counter where it will collect dust. Electric ranges, however, which are too bulky to inclose, are set along the glass wall next the corridor. Toasters, flatirons, percolators, etc., are displayed on shelves in the wall cabinets, which are provided with sliding glass-paneled doors. Beneath these cabinets are deeper cases in which are kept special goods, like heating coils, large hot-plates, radiators, etc., which are too bulky to set in the upper cabinets, but which must be at hand if called for. The tops of the deep cases form counters on which appliances can be set when removed from the cabinets for inspection. Pads are provided on which to set the articles when they are transferred to the counter so that the latter will not be scratched by persons moving the device around. Electric-service outlets on the front of the case permit showing the various devices in operation.

In one corner of the room is a special cabinet with sliding shelves on which are set hot-plates. This cabinet is employed, as it was found that too much space would be required if the hot-plates were set on one edge in an inclined position on shelves. Moreover, if ordinary wall cases were used for this purpose, it would be inconvenient to remove the heavy hot-plates to a place where they could be brought under close inspection.

With the equipment employed it is possible to set all of the plates horizontally on the shelves, thereby economizing in space and bringing all of them within convenient reach. When a customer asks to see hot-plates the salesman can pull out the upper shelf, which is about waist high, and show the contents thereof without removing the devices. If those shown are not just what is wanted, one of the lower shelves can be similarly withdrawn and, without stooping, the salesman can call attention to features of design by comparing with corresponding parts on the upper shelves. Furthermore, when the customer leaves, only a moment is required to slide the shelves into place and close the cabinet, whereas in many shops it is necessary to replace each device, with possible injury to the furniture. The shelves are specially braced like filing cabinets to withstand the weight when withdrawn and are supported on

roller bearings which allow them to be moved with ease.

After customers have been given an idea of the different designs of a certain article kept in stock, it frequently happens that they are unable to decide for themselves which one to purchase. In such cases the demonstration table previously referred to is of considerable value. It is provided with a glass top and three velours pads placed symmetrically. From remarks that the customer has made while the salesman is demonstrating articles he is usually able to tell between which articles the choice lies. He therefore takes one of these from the wall counter, places it on the end pad, and proceeds to call attention to the points which are particularly favorable to the customer.

As the table is placed so that a customer will have his back to the wall cases when looking at anything on the pads the article so displayed is made the center of attraction. If one or two other articles must be presented before the customer makes a decision, each of the previously exhibited articles is moved along the table to one of the other pads so the last-displayed device stands by itself. After two or three of the more favored articles have been presented the customer is asked to choose between those standing on the table, which is usually an easy task as compared with choosing from a group of several articles.

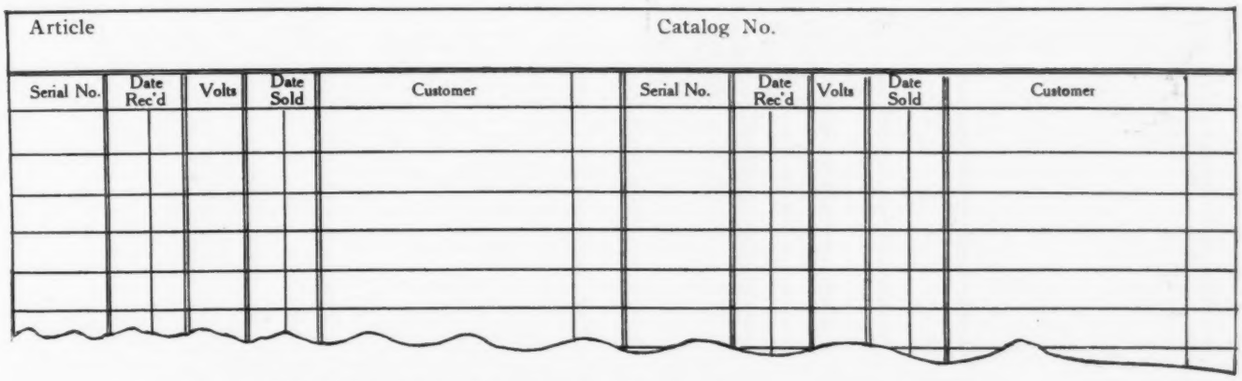


FIG. 2—CARD INDEX SHOWING RECEIPT AND DISPOSITION OF STOCK

Other Features

As customers frequently call salesmen on the telephone while they are engaged in making a sale, a desk-type telephone has been placed in the display room. Rather than make an exception to the rule that no articles be allowed to stand on the counter or table, the flexible conductor has been connected with a terminal block inside the wall cabinet, so the telephone must be placed inside before the door can be closed. The reason for having the telephone installed in this manner rather than in another room is that the customer does not have to wonder when the salesman will return, and will therefore not become so impatient.

Illumination is furnished by three opal-bowl semi-indirect fixtures. Each of these contains three 40-watt tungsten lamps and one 200-watt gas-filled lamp. These are controlled from switches at each end of the room, it being possible to turn on the 200-watt or 40-watt lamps alone or together. When no customers are present only one group of lamps is ordinarily lighted.

Receiving and Shipping

The receiving and shipping room connects with the stockroom and is on the corridor, through which packages can be conveyed on trucks to and from the freight elevator. When goods are received, entries are made in a receiving record to show the case number, date received, contents, method of transportation and other items. If the shelf stock is depleted, the case is usually opened; if not, it is left untouched. This is especially true of articles which will probably be shipped as received. Cases received from the factory have their packing slips tacked to the ends between cleats so they can be removed for determining contents when cases are to be reshipped to dealers. If a case so shipped is found by the dealer not to contain the items specified on the packing slip, the factory is held responsible.

From the receiving record data are transferred to a card-index file. A sample card is shown herewith. It

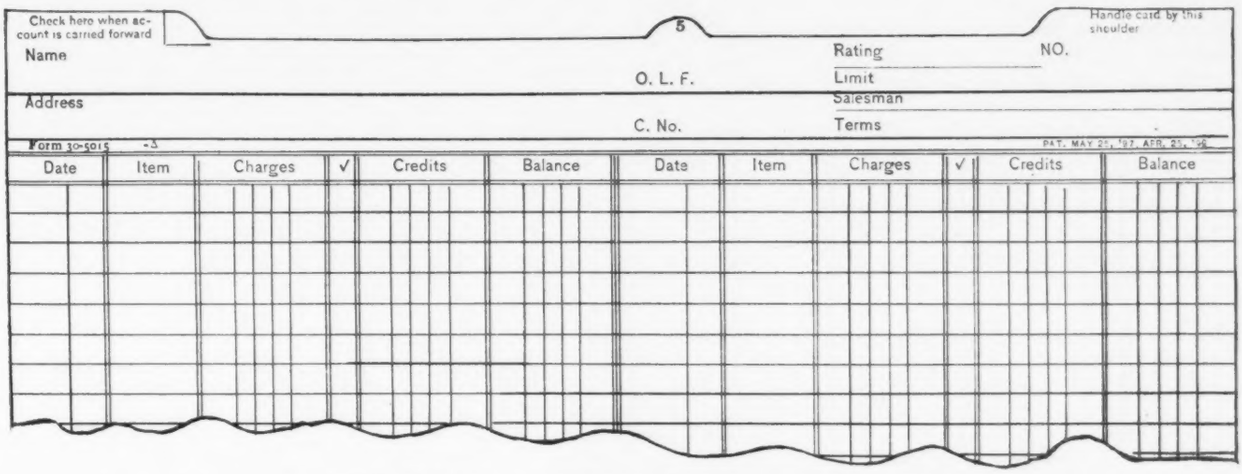


FIG. 3—DOUBLE-FACED CARD-INDEX LEDGER FOR EIGHTY ENTRIES

contains columns for serial number, date received, voltage, date sold and customer. Records of cash paid out or received and of merchandise bought or sold are kept in an eight-column journal and the proper data transferred to a card-index ledger, one of the units from which is copied herewith. It contains spaces for eighty entries. Orders are made out in triplicate. One copy is kept in the office for reference and making out bills, the original is sent to the shipping room for filling, and the third, which is a tissue-paper copy, is left in book as a check to see that all goods are followed by a bill. Factory bills are checked with the receiving record.

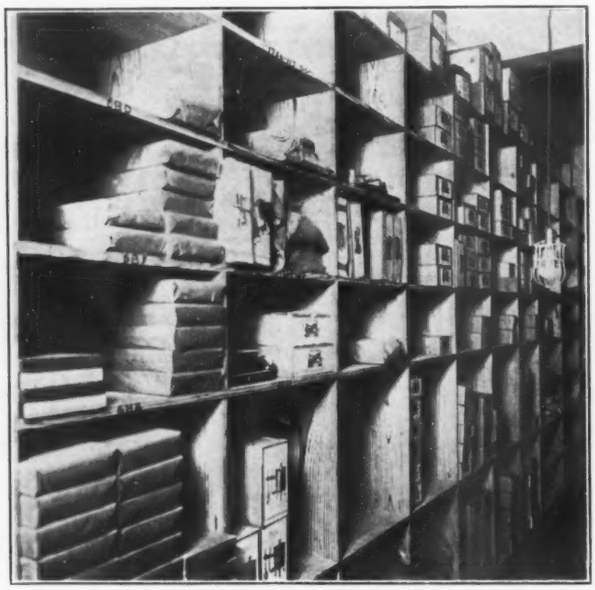


FIG. 4—SECTION OF STOCK ROOM

The order which is sent to the shipping room is kept in a file marked "Unfilled Orders" until all goods are shipped. If only part of an order can be filled, "Part Shipment" is marked at the bottom and the names of the articles shipped on the back of the shipping order, which goes through the bookkeeping department and is then returned to the shipping room, thereby eliminating need of back orders and cross indexing. After goods have been shipped the information is entered on the order and sent to the bookkeeping department, where a clerk looks for the corresponding office copy previously mentioned and makes out the bill. A duplicate of the latter is then fastened to the duplicate order and filed under the ledger number of the customer. The original order is filed in serial order in a separate cabinet. Periodically a clerk goes through this file to see that no orders are missing, and if any are he refers to the copies in the order book to get the customer's name, after which the duplicate order can either be found in the shipping room still unfilled or in the file with the bill attached.

Stockroom

The stockroom connects with the office, shipping and receiving room, and display room. This is a convenience, as clerks in the office or salesmen in the display room can personally inspect the condition of stock without traveling a long round-about way. The stock is kept in wooden compartments, which are labeled with catalog numbers and the voltage of the appliance. Similar articles are grouped together, all having the same column, but separated according to voltage. Exceptions have been made to this arrangement by placing all copper-finished articles in one set of compartments, and 220-volt stock, which is not called for very often, in another group. Red labels indicate copper finish, and black designates nickel.

FIG. 6—REPAIR ROOM

Repair Department

Purchasers are urged to send in appliances as soon as they need repair. For this work Mr. Williams maintains a repair department which adjoins the stockroom. The repair parts are kept in small wooden compartments labeled with the catalog number and voltage of the article to which they belong. After a device has been placed in working order, "R1" or "R2" (depending on whether it is the first or second repair) is stamped after the serial number on the unit. An office record is kept of repairs so that if a customer complains that his repair bill is high it will be possible to tell him whether he waited and sent in all of his devices at once or whether they were repaired from time to time. This was found necessary as some persons lay electrical units on the shelf when they burn out and do not send them in for repair until several have accumulated. Then when the bill comes in it looks as though all of the units had "gone to the bad" at once. Another reason for urging customers to have their repairing done by the agent is that the work will be done properly, which may not be

FIG. 5—TYPE OF ADVERTISING EMPLOYED TO NOTIFY PUBLIC OF CHANGE OF ADDRESS

the case if the owner attempts to correct matters with a hammer, chisel or screwdriver.

To insure repairing articles in the order in which they are received they are placed on shelves labeled with the day of the week. Other compartments are provided for articles which are to be held, called for, shipped, or for which the cost of repairs is to be estimated. The repairman is required to clear up each day's work consecutively. If devices must be repaired on short order they are tagged "Rush" and left on the repair bench.

Mr. Williams prides himself on the speed with which he handles repairs, the rapidity with which his clerks can give information regarding goods on hand, shipments, etc., and his methods of displaying goods. He believes in selling devices for the additional business they will bring and not for the profit which he will secure on the particular article sold. His policy is to satisfy customers not only with the design, but with the reliability, maintenance, repair and operating costs of the establishment.

Electric Vehicle Situation in New England

Central-Station Managers Discuss Maintenance and Operation Cost of Electric Vehicle and Other Commercial Subjects at N. E. L. A. Convention

ONE of the most interesting and instructive conventions held in New England convened in Boston on March 11 and 12. The New England Section of the National Electric Light Association held a two-day "question box" session at that time, which provided for full and free discussion, without formality, of live topics of central-station interest. The first day's session was given over to operating and public policy matters, and an account of that session is given elsewhere in this issue. The second day was devoted to storage batteries, accessories and the electric vehicle, and the ideas brought out on these topics, together with those on some other commercial subjects, are given in what follows.

Electric Automobile Topics

Mr. F. B. Neely, Philadelphia, presented data bearing upon the life of "iron-clad" batteries, one of which, four years in service, has run 35,000 miles. Thin plate cells have a working life of from 350 to 450 working days and have operated up to 8500 miles, negative plate life reaching 630 days. The speaker, with others, emphasized the importance of taking out substantially the full charge of the battery regularly in order to get the best service. Mr. Neely described the constant-voltage method of battery charging, which expedites this work, but this method was criticised on account of its first cost by subsequent speakers. The tendency among central stations to increase the size of garage conductors was mentioned. Special attention has lately been given to the reduction of breakage in the removal of elements from cells. Methods of reducing shocks to cells by trucks backing against platforms were briefly discussed, including the adoption of the flexible jar and replacing the solid lead connection with lead-coated copper.

Other speakers advocated standardizing batteries at forty-two or forty-four cells, pointing out that the cost of charging is as great for a battery of twenty-four cells as for the larger number.

Mr. C. F. Smith, Boston, recommended that chains be treated by boiling for an hour in a caustic solution, immersing in tallow and beeswax, and then replacing, with the daily application of heavy cylinder oil. At the Amoskeag Mills, Manchester, N. H., a chain-cleaning and lubricating equipment has been developed which runs the chain through a bath of oil. Two sets of chains are provided for each electric truck, and these are changed weekly.

Mr. W. M. Thayer, Hartford (Conn.) Electric Light Company, described a new offer by which each purchaser of a General Vehicle electric truck during 1915 at Hartford is to receive a dividend based upon the size and number of trucks bought. The dividend will be declared on Jan. 1, 1916, and will range from $4 times the number of 750-lb. equipments placed in service to $14 times the number of 5-ton trucks delivered, the maximum dividend on the former size being $100 and on the latter $350 per truck. Sixty-one electric trucks are now in use under the company's battery service system, and these have run more than 1,000,000 miles and operate in eighteen distinct lines of business.

The Buzzards Bay company is soon to introduce a plan of battery charging which will provide electric-garage rates comparable with the retail price of gasoline. The object is to enable the garage owner to make as good a profit from battery charging as from the sale of gasoline. Every large town in southern New England now has an electric-charging station. In further discussion a number of central-station men advocated the building of electric vehicles for passenger service with less ornamentation than the majority of the present types. What is wanted by business men is a moderate-priced, serviceable car good for 30 miles or more on a charge.

Mr. A. F. Townsend, Blackstone Valley Gas & Electric Company, Pawtucket, R. I., submitted data as to the cost of operating two Bailey electric runabouts through 1914, the machines being used by the superintendent of the Pawtucket division, by the meter department and in street-light patrolling. The total cost of operation and maintenance for the year was $2,577 for the two machines, or 7.39 cents per car-mile; fixed charges were $920.10, or 2.62 cents per mile, and the total expense was $3,497.10, or 10 cents per car-mile. One machine ran 14,822 miles and the other 20,041 miles, the respective energy consumptions being 9161 kw-hr. and 10,971 kw-hr. on the direct-current board, the average energy consumptions being 0.62 kw-hr. and 0.55 kw-hr. per car-mile respectively. Electricity was billed to the cars at 3 cents per kw-hr. One car averaged 44 miles per day and the other 60 miles. Unit data for the two cars together are as follows: Energy, 1.73 cents per car-mile; tires, 2.38; operating labor, 0.68; repairs, 2.32; miscellaneous, 0.13; distilled water, 0.10; battery solution, 0.05; total operation and maintenance, 7.39; depreciation at 12.5 per cent, 1.59; interest, 6 per cent, 0.76; insurance, 0.27; total fixed charges, 2.62 cents; grand total, 10.01 cents per car-mile.

Mr. Townsend also gave the following figures of operating cost for a 1912 model 1000-lb. Baker electric delivery wagon in the company service, covering twenty-five months ending Jan. 31, 1915. The car ran 14,426 miles at a total cost of $2,257.26, or 15.53 cents per mile. The unit items, all in cents per car-mile, were: Tires, 1.35; electricity, 2.44; lubrication and waste, 0.04; rectifier tubes, 2.13; electrolyte, 0.02; washing and oiling,

0.36; testing batteries, 0.01; miscellaneous, 0.14; accident insurance, 0.79; fire insurance, 0.41; property damage, 0.31; miscellaneous supplies and expenses, 0.43; truck supplies, 1.47; battery supplies, 0.01; truck labor, 2.48; battery labor, 0.18; fixed charges, 2.9; total, 15.53 cents.

Relative Progress of Electric and Gasoline Vehicles

Mr. P. D. Wagoner, General Vehicle Company, Long Island City, N. Y., stated that the electric vehicle is making relatively slow progress as compared with the gasoline machine, but that the former is by no means at a standstill, considering the unfavorable conditions of business. Among the reasons why the "electric" has not been so freely purchased in the past as could be desired are lack of definite appreciation as to the limitations and capabilities of the equipment, incomplete understanding as to the relative economic advantages of the electric and the gasoline vehicle, lack of confidence in the business electric vehicle as a standardized device far beyond the experimental stage, lack of understanding of the simplicity and economy of the electric vehicle in operation and maintenance, and uncertainty as to the storage battery. The pessimist in the central station tends to keep back a whole city from the benefits of electric-vehicle service. Careful adaptation to service is of great importance. More than 60 per cent of the orders are repeat orders, which shows satisfied users, even if the electric gospel spreads slowly. The speaker questioned if the time were ripe for the production of a low-cost vehicle, in view of the demand for high mileages per charge. If the manufacturer could be sure of a good demand for a light-weight cheap electric vehicle, produced in quantities to be absorbed by present users who are experienced in the operation and proper care of "electrics," the venture might be a success. On the central-station side, many investors fail to realize the possibilities of increasing dividends through off-peak battery charging, which requires little or no additional investment, and which can be applied to the noon valley in the load curve as well as to night operation of plants, when the cost of the additional energy for charging is so small that it cannot be found in the coal consumption. The speaker pointed out that unit costs of electric-vehicle service are apt to be higher in central stations than in commercial deliveries, on account of the protracted periods of standstill in the former case due to local work which must be done before a car can move on to the next place.

Mr. Fred H. Smith, Worcester, Mass., said that the Worcester Electric Light Company stands ready to assist local purchasers of commercial electric vehicles to pay for their machines on the instalment plan. He submitted extended data as to total costs of service for eighteen months in company machines ranging in size from runabouts to a 7000-lb. cable truck, including all fixed and operating charges. These ranged, figuring energy cost at 2 cents, from 11.2 cents to 60.6 cents per car-mile, the usual cost being from 11 cents to 13 cents. In the cable-truck service the maximum above quoted is far above any other figures on account of the long standstill periods when the machine is hauling cable through ducts, etc. Mr. Smith said that, while the unit costs are fairly high, the company simply could not begin to do the work with horses that is performed by electric vehicles.

Mr. Arthur D. Putnam, Worcester, said that upkeep cost is favorable with the electric vehicles on account of their moderate speed.

Electric Vehicles in Winter Time

A brief discussion touched on the use of electric vehicles in snowy weather, the wisdom of a boosting charge in the noon hour being emphasized by several speakers. It was generally held that electric trucks stand up to their full daily mileage even in snow, provided that the company gives the boosting charge. The energy consumption may be increased 30 per cent.

Mr. C. F. Smith, Boston Edison company, said that by reducing the sprocket and gear ratio in snowy weather good results in mileage are obtained. He emphasized the importance of routing machines so far as possible to use up substantially the full charge of a battery daily in order to be able constantly to realize the capacity of a given equipment. Another speaker said that if an overcharge is given twice a month, a battery not fully discharged daily will give its rated service. Some discussion also took place relative to the need of more accurately determining motor requirements.

Mr. K. A. Skinner, Providence, R. I., urged the importance of keeping spare controller parts on hand so that protracted delays in truck service due to minor troubles can be avoided. Failure to do this in one case tied up an eighteen-hundred-dollar truck for seven weeks. Mr. Day Baker, Boston, said that electric truck manufacturers cannot as yet afford to put in trial machines for extended service. He reviewed the successful performance of many trucks in snowy weather and, in answer to the question why truck weights are not lower, cited instances where owners had grossly overloaded their machines. Figures were presented by the Malden (Mass.) Electric Company to the effect that the cost of service with two Bailey electric roadsters, figuring all charges, was from 11.5 cents to 12 cents per car-mile during a recent six months' period.

Fire-Department Service

The discussion was followed by a brief one on electricity in fire-department service. Mr. W. O. Adams, Eldridge Manufacturing Company, Boston, said that about fifty machines are now electrically driven, the most notable installations being in Philadelphia, Pa., and Springfield, Mass. The advertising value of electric fire apparatus is very high. The routes are fixed, the equipment receives good care, and the batteries are likely in most cases to be required to propel their equipment not more than 500 miles per year. With proper care the equipment is absolutely reliable. Mr. Day Baker said that the original batteries are still in service at Springfield. Every tray in the department is interchangeable, and one extra tray of batteries is carried in each engine house, each tray being completely discharged once a week. The cost of electricity for the Springfield service would hardly feed six horses. The revenue from this service is low, but it is well worth while for central stations to encourage the use of such equipment from the publicity standpoint.

Electric Ranges

The use of pilot lamps on electric-heating appliances was generally commended as a measure of safety and economy. A brief discussion of the diversity factor of electric ranges occurred. Citing an apartment house in Worcester, Mass., which has been equipped with Simplex ranges of the electric type only, with no coal-burning or gas ranges in the building, a speaker pointed out that recent tests showed a maximum demand with thirteen ranges in use over a month of 13 kw. With all the heaters on at the maximum rate the load of these outfits would total 65 kw, giving a diversity factor at the building of one to five. Scattered through a town the diversity factor would be still better, perhaps one to six. The users of these ranges averaged three per family and had no previous experience with electric cooking.

Mr. L. A. Gale, Simplex Electric Heating Company, Cambridge, Mass., stated that a well-distributed electric-range load should have a diversity factor of one to seven,

but that as the maximum demand does not come on the central-station peak, this can be figured at one to ten, exclusive of distribution losses. Tests show that 1 kw-hr. per person per day is a fair average for electric-range service the country over. On this basis a 3-cent rate makes the cost of electric cooking about equal to that of cooking by coal, or by gas at $1 per 1000 cu. ft. Mr. Gale referred briefly to the load imposed by the electric-range installation at the Engineers' Club, Boston, which is a difficult service in view of the need of meeting demands for a varied menu at all sorts of hours. On a representative day the load was as tabulated below:

Time	Kw Demand	Time	Kw Demand	Time	Kw Demand
1-5 a.m.	2	11 a.m.	11	6 p.m.	12
6	5	12	12.5	7	6
7	12	1 p.m.	10	8	8
7:40	18.5	2	5	9	6
8	16.5	3	7	10	5
9	17	4	7.5	11	5
10	16	5	12	12	5

Other speakers emphasized the importance of allowing a range user at least a month in which to learn how to handle the apparatus economically. In one case the bill was cut from $21 to $9 in one month by instructing the range purchaser in its proper use.

The Customer

The point was made that if stickers are gummed to bills advertising matter is sure to receive more attention and be less liable to go into the consumer's waste-basket. An extended discussion of the practice of allowing industrial consumers motor-service rates on their lighting loads brought out the point that many companies allow from 15 to 20 per cent of the energy consumption to be billed for lighting at the motor-service rate. At Fitchburg, Mass., 15 per cent of the energy used for motors is credited at the lighting rate, the excess being deducted from the lighting meter total and the balance billed at the lighting rate. At Providence, R. I., a customer with 200 kw demand or more is allowed a lighting load not to exceed 20 per cent of the motor-service load. At Worcester, Mass., a customer having a motor rated at 50 hp or more can put 20 per cent of his motor load on the lighting bill at the motor-service rate, the customer furnishing his transformer. Mr. R. W. Rollins, Worcester, said that after a customer has been shown the interest and depreciation upon a motor-generator installed for lighting and has been given the cost of the losses in such apparatus, he is generally content to use energy for lighting at the lighting rates.

The central-station companies managed by C. D. Parker & Company, Boston, offer a manufacturer a complete installation of electric motors ready to operate, and allow him the use of this equipment for a trial period of one year, the customer paying 15 per cent on the retail price of motors and the contract price of the installation. If at the end of the year the service has been satisfactory and the customer desires to continue its use, the company will either sell him the motor equipment at the price contained in the lease or continue to lease it to him on a 15 per cent basis. If the manufacturer does not continue to use electric drive, the company will remove the equipment from his premises and reconnect his machinery in the manner in which it was found, at the central station's expense, the manufacturer paying during the year's trial the regular rate in force at the time for electric motor service. This offer eliminates the fear of the manufacturer of investing capital in a new form of power drive with which he is not conversant, and which he fears may not live up to the statements made by the salesman. A somewhat similar proposition is made with gas-filled lamps and "brascolite" fixtures, for a trial period of from one to six months.

Electric Heating of Water

Mr. R. J. Patterson, Central Maine Power Company, Augusta, Me., presented the results of experiments in the development of equipment for heating water electrically in domestic service. The speaker employs cartridge-type units of a combined maximum rating of 2400 watts, installed in a chamber permitting the free circulation of water from bottom to top. With this equipment it is possible to draw water at from 110 deg. to 116 deg. Fahr. after a short wait, satisfying ordinary domestic requirements at a total cost of about $1 per week. The apparatus was tested with an input of 4400 watts and raised the temperature of 145 lb. of water from 46.4 deg. to 140 deg. Fahr., at an efficiency of 90.3 per cent. Although the equipment is not as yet made commercially, two customers of the Central Maine company are using it to advantage, and it is hoped that one of the most difficult problems in electric heating is in a fair way to be solved by this means. Other subjects discussed will be given in a subsequent issue.

LIGHTING AT SAN DIEGO EXPOSITION

Illumination Effects Are Attractive Features of the Southern California Exhibition

The illumination at the Panama-California Exposition at San Diego is one of the most attractive features of this Southern California exposition. The plan of outline lighting was not followed, as it was desired to secure softer effects more in keeping with the Spanish colonial architectural style which characterizes the buildings. The main buildings have no visible lights on the exterior. On the principal avenues and plazas of the Exposition grounds black acacia trees are planted on 16-ft. centers. The trees, trimmed in semi-formal style, are about 12 ft. to 14 ft. high, and are in rows 22 ft. from the buildings. Between every two trees is a decorative staff lamp-post painted to imitate old bronze and holding an acorn-shaped diffusing globe, 9 in. by 14 in., containing a 500-watt vacuum tungsten lamp. Usually the lamps are several feet below the tops of the trees, and they are therefore shaded. The center of the filament of the lamps stands 10 ft. 8 in. from the curb line. A glance down the street shows plainly only the first two lamps on each side, while the others are shielded effectively from the eyes. The lamps in this way illuminate satisfactorily the building walls and the street.

The lamp-posts contain 3-in. iron pipes set 2½ ft. in the ground in concrete, which is carried above the ground 8 in., forming an octagonal base about 2 ft. across to carry the staff work. The staff post holds a zinc fitter especially spun to provide for architectural details of the post. In the base of the post a small sheet metal box contains a fuse block. From this point the wiring is carried into the 3-in. pipe and connected to a "Mogul" socket.

Ornamental cast-iron brackets were used around the entrances and some plazas where ordinary street posts were not suitable. These have the same type of acorn diffusing globes and either 500-watt or 250-watt lamps according to the spacing used. In the picnic pepper grove and along paths in the parks a less pretentious type of post is used. This is 8 ft. 6 in. in height and of redwood painted to imitate old bronze. Each post is slotted in the lower portion so that a conduit from one post to another may be brought above the ground and a tap made for individual lamps. A fuse block and cast-iron frame to cover it are embedded in the square wooden base. This post is set 2½ ft. in the

ROADWAY LAMP STANDARDS AND COURT LIGHTING, PANAMA-CALIFORNIA EXPOSITION

ground with an 8-in. concrete base above the ground. Each post has an acorn-shaped globe, 8 in. by 12 in., and a 250-watt lamp. Except in the pepper grove, where a series system was used, the multiple system of wiring is employed in all cases and 250-cp nitrogen lamps were used. Some doubt was expressed as to whether gas-filled lamps would bear the heat under the inclosed globe, but up to the present time there has been no trouble. Ornamental cast-iron two-unit posts, with 250-watt lamps in each unit, were used on the permanent concrete bridge across Cabrillo Canyon. The posts are spaced about 68 ft. apart on the bridge. In the formal parks and the pepper grove they are 100 ft. apart.

Effective use was made of the arcades which, in keeping with the Spanish colonial type of architecture, line every street on both sides. The arches have a typical spacing of 13 ft. on centers. Centering on each arch in every arcade is an ornate plaster indirect fixture. The inside of the fixture is smoothed and finished in enamel on the plaster, as it was found cheaper and as efficient to have the inside of the bowl its own reflecting surface as to provide another reflector. Each bowl contains four 25-watt tungsten lamps. The arcade is about 14 ft. high and 13 ft. wide, and the ceiling has a warm but light tint which gives a very satisfactory reflection.

The Exposition furnishes light inside of the buildings for janitor service only. For this purpose 250-watt lamps are installed in deep bowls of white-frosted enamel reflectors. These units are about 22 ft. above the floor and 36 ft. on centers between trusses. Individual exhibitors light their own spaces.

The amusement section is called the "Isthmus," and concessionaires are required to light the fronts of buildings to the amount of 30 cp to the front foot or otherwise to the satisfaction of the Exposition. The Isthmus is 60 ft. wide. Except in a few small low booths where the specified requirement has been met, the average is about 45 cp to the front foot on each side. In this section outline lighting is

used, and the average gives sufficient illumination for both decorative and street-lighting purposes. In most parts installation is required of 10-watt frosted sign lamps. Good effects have been secured from colored lamps and flashers. Two outdoor shows have lighted their spaces from poles 100 ft. high with reflectors at the tops to carry 1000-watt nitrogen lamps, giving a good imitation of moonlight effect.

All energy in the Exposition grounds is supplied by the San Diego Consolidated Gas & Electric Company. An 11,000-volt, three-phase feeder extends directly from the generating station on the bay shore to a substation in the grounds. Distribution is made at 2200 volts underground to transformer rooms in the various buildings, where 2200/220-110-volt transformers are installed.

Secondary circuits run from the transformer rooms to the street, arcade and building lamps and also to light and motor-service buses under the building for exhibitors' use. As the street and arcade lamps are fed from separate primary circuits and are controlled from the substation they may be turned on at dusk or off at midnight simultaneously. An operator visits each transformer room before midnight and throws a double pole switch from the secondary street-lighting bus to the twenty-four-hour bus so that a few lamps for protective purposes burn after midnight. With the exception of two short lines back of the Isthmus, the poles of which are concealed by the buildings, all distributing lines within the grounds are underground.

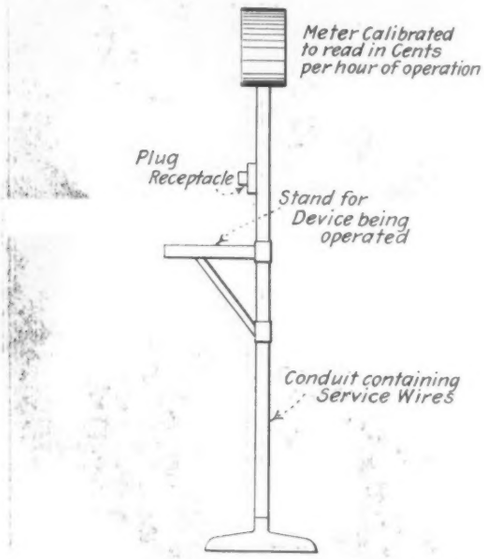
The underground conduit system is formed of fiber duct laid in concrete. Lead-incased, rubber-covered wire was used on the 2200-volt distributing system on the principal circuits. Rubber-covered wire without lead casing was installed in outlying districts. A box-conduit system was installed under buildings. This consists of cross-arms at frequent intervals secured to floor joists, carrying glass insulators which support weatherproof wire.

ELECTRIQUETTES AND LIGHTING OF PANAMA-CALIFORNIA EXPOSITION

Merchandising Methods

Showing Operating Cost to Sell Devices

After a customer has been interested in an electrical appliance and has been shown that the value of the service it will afford is far greater than the price asked, it sometimes remains to convince him that the cost of energy for operating it is negligible. To furnish proof of the last-mentioned selling argument, one of the branch offices of the United Electric Light & Power Company, New York City, is employing a meter calibrated to indicate directly the exact cost in cents of operating any device one hour. Persons doubting any


Meter Calibrated to read in Cents per hour of operation
Plug Receptacle
Stand for Device being operated
Conduit containing Service Wires

METER SHOWING OPERATING COSTS

salesman's statement as to the operating cost of a device can be shown exactly what the unit cost is with this instrument. Moreover, it can be employed in answering complaints regarding high bills to show the cost of operating differently rated lamps and household devices.

Salesmanship and Advertising

The close link that exists between salesmanship and advertising was emphasized by Mr. Martin J. Wolf, sales manager for W. N. Matthews & Brother, St. Louis, Mo., in a talk before the Chicago Jovian League on March 15.

"Salesmanship," quoted the speaker, "is advertising plus getting the order signed. Advertising is salesmanship plus publicity." The successful salesman must possess the qualities of knowledge of his goods, systematic industry, honesty, enthusiasm and optimism. Many a man has failed, declared Mr. Wolf, because he neglected to plan his work. The salesman, for example, must apportion his time so that his calls will represent the relative value of customers' business. Each minute must be made productive.

Every business transaction can be traced to one of the following five elementary motives, declared the speaker: "Money, utility, pride, caution, and weakness or self-indulgence." It is to one of these motives that the skilful salesman invariably appeals. In applying this principle, however, the salesman must be guided where possible by the personal characteristics of the prospective customer. Aggressive, enthusiastic men who seize and act upon ideas quickly are often blond in complexion, while brunette types, asserted Mr. Wolf, are likely to be more conservative and reach decisions more slowly. This point is often of value in knowing how far to press sales arguments upon customers. Physiognomy, in its analysis of countenances in which the mental or the vital characteristics predominate, often helps the salesman in formulating his approach to an unknown prospective customer.

Selling Small Motor-Driven Apparatus at Toledo

Coffee mills, grinders of all sorts and other motor-driven general-utility apparatus have recently occupied a conspicuous position in the salesroom of the Toledo (Ohio) Railway & Light Company. Plans for selling this class of apparatus have occupied an equally important place in the minds of the company's salesmen, for the "bogy" set for 1915 is 6000 hp, and it is expected that a large percentage of this total will be disposed of in small units.

In the three months just prior to Jan. 1, 1914, an aggregate of 2250 hp in electrical apparatus was sold. To maintain high selling efficiency, such as was evident during the latter part of last year, it is proposed to enlist the aid of manufacturers' agents in selling the electrically driven specialties, and to make attractive prize offers to the central station's salesmen showing the greatest volume of profitable sales.

Soliciting Electrical Contracting

Many electrical contractors do not give proper attention to the soliciting of new business. This is especially true in the case of those electrical contractors engaged in the house-wiring business. The obtaining of contracts for electrical work already proposed should not be the limit of an electrical contractor's ambition. Many persons are in the market for electrical contracting, and, knowing the name of no reliable contractor, seek the nearest "curbstoner," with the belief that all persons engaged in the electrical contracting business are equally reliable. Others need only to have the advantages of electricity in the home pointed out to them by mail or by personal calls in order to create in them a desire to have their homes wired. Still others need only such information as the advantages of separate circuits for heating devices, their cost, etc., to reach a decision to have additions to an existing system of wiring made.

Entertaining beliefs such as these, and believing that the electrical contractor like other business men can well profit by the use of modern business methods, Mr. S. May, an electrical contractor of New York City, employs numerous modern methods of attaining business. Throughout that large city one sees frequently such signs as "Wire to May to wire." In addition, the firm's telephone number and the location of its several places of business are generally given. Newspaper and program advertising are also extensively employed.

New work is solicited through the mails and by means of a corps of solicitors. In this way the firm not only keeps its name constantly before the public, but, through the newspapers, theater programs, the mails and personal calls by solicitors, it is able to create in many cases a desire for house wiring, alterations, extensions, repairs, etc. Having created a desire for electrical work, the securing of a contract for the work is an easy matter.

No attempt is made to "key" the firm's advertisements, but the numerous cases where persons telephone, call or write saying that they saw a certain advertisement, etc., fully convince Mr. May that advertising pays.

Show-window signs and displays are also employed by this firm. The value of show-window signs and displays is well illustrated in the case of the Freeman-Sweet Company, Chicago, Ill. This firm, when removing to its new place of business in the Transportation Building, decided to maintain a retail supply store. This was done not merely because such a business was deemed profitable but also because the members of the firm believed that frequently changed and attractive window displays with placards reading, "Let us give you these advantages in your home," "Consult us about your next job of electric wiring," "Do it electrically," etc., would bring in new business from passers-by. The amount of business obtained in this way showed such advertisements to be invaluable.

Guaranteeing Sales on a Money-Back Basis

"The electrical supply jobber is an economic necessity," declared Mr. W. N. Matthews, of W. N. Matthews & Brother, St. Louis, Mo., in his address before the joint meeting of jobbers and manufacturers. As a middleman between a multitude of manufacturers and consumers, the jobber, continued Mr. Matthews, has an established place, and his function is to enable the dealer and consumer to place their orders for a variety of merchandise with one concern. The more complete the stock of articles of approved quality carried by the jobber, the greater his service to the user—his customer.

The demand for electrical materials was, figuratively speaking, "born a full-grown man." The infant electrical business found a distributive organization of limited serving capacity on which were thrust its perplexing problems of supplying varied and rapid demands. The natural result was a mixed development.

In some lines the electrical supply jobber proved equal to the emergency; in others the service development fell to the manufacturers.

The reasons for many manufacturers having developed sales organizations that are in a measure parallel to that of the jobber are fivefold:

First—The tremendous strides taken by the industry, a growth that is equaled by only two industries in the entire history of commerce.

Second—Inability of the earlier jobbers at first to give service in a broad sense, because of the highly technical nature of the merchandise and the lack of trained salesmen. This, coupled with scant capital, made the pioneer electrical supply jobber unequal to the rapidly growing industry.

Third—The consequent timidity on the part of the jobber to stock goods until the market was created by the manufacturer. When this was done, it gave the manufacturer control, instead of the logical distributer—the electrical supply jobber.

Fourth—Hand in hand with the phenomenal growth of the electrical business was the development of productive advertising. The electrical manufacturer has always been a creative advertiser, which has placed him foremost in the thoughts of the electrical buyer.

Fifth—The heretofore comparative lack of ruinous competition between manufacturers has meant more liberal profits and easier manufacturing conditions; consequently more time to devote to strictly distributing questions.

The Policy of "Service"

The jobber who is doing what his success in business demands to-day is making his stock so complete, his delivery so prompt and his relationship with his customers so pleasant that his stocks and organizations are actually reserve service quantities for those needing them.

The suggestion offered by Mr. Matthews is, then, to go a step farther and guarantee the efficiency of employees and merchandise. If the jobber picks his employees with care, he can assure and guarantee their performances. He can put on his stamp a guarantee of absolute satisfaction if he uses equal care in selecting his brands of merchandise, because the manufacturer must and will stand back of him in this guarantee. "If the manufacturer cannot do this or refuses to do this, don't handle his goods," urged Mr. Matthews. "You are practically guaranteeing everything you sell now, because good business policy so dictates. There is very little that you handle that cannot be bought from some manufacturer who will protect you in your absolute guarantee. If you guarantee all your merchandise and all of your service, and properly educate your customers by proper publicity, their mental activity will be as follows:

"First—I need electrical material.

"Second—Will the electrical supply company guarantee it?

"Third—How much will it cost?

"Fourth—How quickly can I get it?

"My suggestion is that the jobber guarantee everything that he handles and cut down the number of lines of the various kinds of merchandise that he carries in stock, in order to correspond with this plan. It will mean the 'survival of the fittest' among the manufacturers. It will mean that every manufacturer to have his line recognized and handled by the jobbers must produce the very best class of goods, and that his guarantee must be back of every article that he makes."

A complete stock of absolutely reliable goods with few duplications will result in: (1) More turnovers; (2) more satisfied customers; (3) more goods sold at regular prices; (4) more net profit; (5) more rock-solid foundations for enduring success.

The electrical jobber should establish himself in the commercial family as the "big brother" to the central station, to the telephone company, to the contractor, to the small dealer, and to the purchaser of electrical goods.

"A-Sign-a-Day-for-a-Year" Campaign Succeeds

The slogan of the new-business department of the Toledo (Ohio) Railways & Light Company—"A sign a day for a year"—is no longer merely the expression of an aim. It is a realized fact, for during the year 1914 more than 500 signs were sold in the city. Mr. A. K. Young, manager of the company's new-business department, in speaking of this campaign stated that the record of the connected load represented by these signs shows an average of a little more than 200 10-watt lamps per sign.

But with this remarkable sales achievement to their credit the solicitors are not relinquishing their efforts to sell signs. In fact, they are aiming to make the year 1915 another continual sign campaign, and expect to average a sign a day during the whole period. At the time this was written a count showed that the average for the new year was a little more than a sign a day.

One of the publicity methods employed consists of placing 22-in. by 24-in. display posters on the front partition of every street car, pointing out the value of "attention-compelling, artistic, 'sign-tific' advertising." These large and attractive posters are secured in large quantities so that a new and different design replaces the one in the car every other day. Such frequent changes of the advertising copy in the preferred space at the front of the car, it is said, will do much to attract the attention of street-car patrons to electric advertising.

Electric Vehicles

New York's Co-operative Electric Garage

The new co-operative electric garage of the New York Electric Vehicle Association is now in full operation with a quota of 100 electric pleasure cars housed and cared for beneath its roof, and the entire project is said to meet all expectations. The task of equipping this large electric garage in New York City was accomplished by the New York Electric Vehicle Association with the aid of three makers of electric pleasure cars—Detroit, Baker and Rauch & Lang—all of whom have made the new garage their New York headquarters with handsome showrooms facing Central Park. The cost of garage service for the ordinary electric car is $45 a month, which includes washing, cleaning, charging and battery inspection.

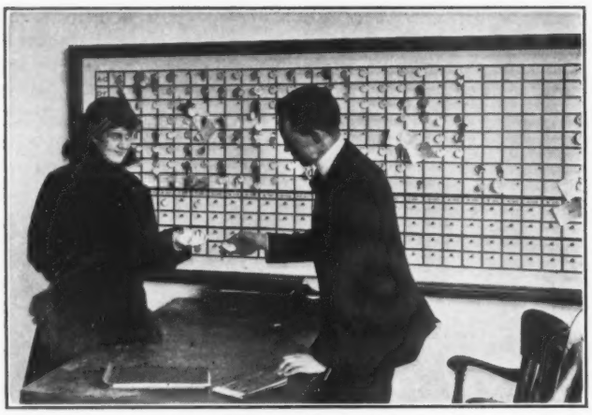


FIG. 1—CALLING FOR CAR OWNER'S KEY

The garage has a number of unusual features, more particularly in its electrical and charging equipment. The charging board is one of the largest of its kind ever built and controls forty-eight charging outlets of varying capacities. Six 750,000-circ. mil cables carry the electricity into the building. These cables have a combined current-carrying capacity of 3200 amp at 120 volts or 400 kw. The garage has a total floor area of 30,000 sq. ft., more than half of which is devoted to the storage of cars and the rest to offices, service and stock rooms and repair shops. There are 8000 ft. of copper wire of large size and 1400 ft. of conduit, exclusive of connecting cables used in the electrical system of the garage. The outlets are so arranged that all of the cars can be charged in their regular positions without shifting or moving. The equipment takes care of batteries ranging from twenty-four lead cells with a charging rate of 8 amp to the sixty-cell Edison batteries requiring 100 amp. The average time consumed in charging a battery at the garage varies from four hours to six hours according to the extent to which the battery has been discharged.

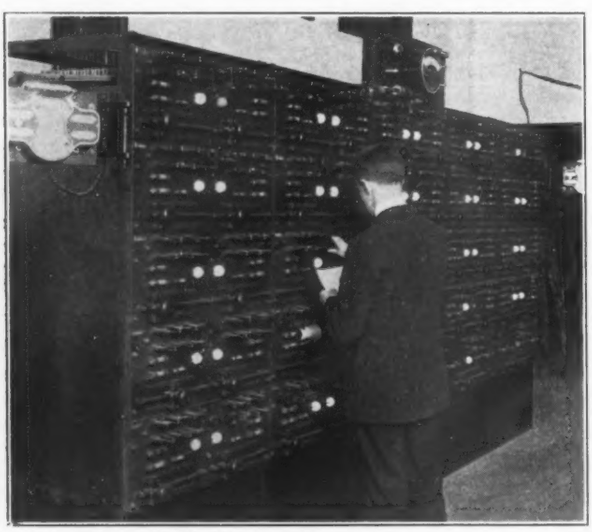


FIG. 2—CHARGING CONTROL BOARD

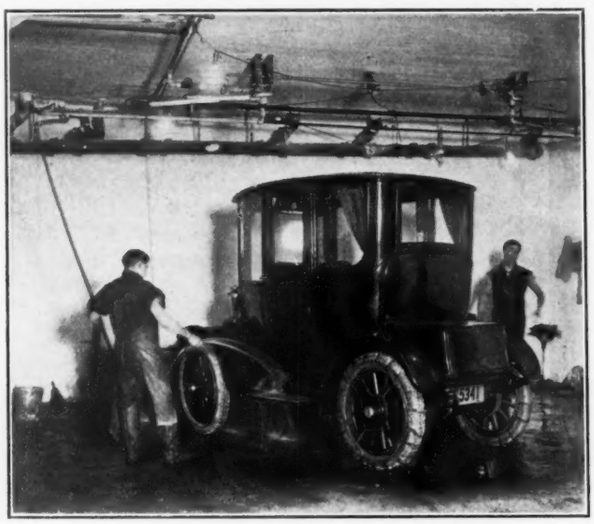


FIG. 3—WASHING CAR IN CO-OPERATIVE GARAGE

How the Vehicle Manufacturer Can Co-operate with the Garage Owner

Vigorous protests against some aspects of the inspection service given by certain electric-vehicle manufacturers to purchasers of their cars, where the result of such inspection is to disquiet the owner and to embarrass the garage operator, were entered by Messrs. Harry Salvat and C. F. Wiedmaier, two operators of electric garages, at a meeting of the Chicago Section of the Electric Vehicle Association, March 9. According to the speakers, the sales agents invite their customers to bring their cars in for bi-weekly or monthly inspections at the local branch offices, and after such examinations furnish the owners with printed inspection forms which list twenty or thirty car parts and call attention to the most minor troubles or maladjustments in a way that often causes the owner to lose confidence in his garage keeper.

Mr. Wiedmaier cited an instance where a manufacturer's agent had stored a customer's car and had allowed the battery to become dry. When the garage operator overhauled the car and discovered this condition, he took every precaution to protect the negligent agent and nursed the battery back to good condition again. Some little delay resulted, and through a cross-connection of the telephone wires, Mr. Wiedmaier found that the agent had, without investigating, explained to the customer that his garage man must be at fault and neglectful of the customer's car, although the garage man was at the time endeavoring to protect the agent's storeroom against the possibility of criticism.

Mr. Salvat urged standardization of electric-vehicle parts as the only solution of the heavy investment burden which the small garage owner must now carry in stock parts. He recommended, especially, unification of styles in battery parts and lamp sizes.

Interior Construction

"Tickler" Prevents Lapse of Mechanic's Lien Rights

All orders for electrical construction work entered on the books of one successful Western contractor are made out in triplicate, the third carbon being used as a reminder for the "tickler," to prevent the lapse of the period for the filing of a mechanic's lien in case the indebtedness is not settled. By filing this reminder in the office date book for a date sixty days in advance of the end of the lien period (usually twelve months from the time of actual completion of the work), automatic warning is given of the approaching lapse of the period for obtaining redress from the courts. When, however, accounts are properly paid in the regular course of events, the triplicate copy of the order is removed from the "tickler" the first thing, so that as the warnings finally appear, day by day, they relate only to actual debtors' cases. This "tickler" scheme has been the means of saving many bad bills, for without some such reminder accounts were often allowed to run far beyond the date when simple legal action could be taken.

Electric Light for Small Stores

"If your store lease soon expires, don't renew without electric light" is the advice given the tenant of the small store by the Electric Illuminating Company of Cleveland, Ohio. "Get after your landlord now. Make him wire the premises at once if he wants you to stay. Tell him that the cost of wiring a small store at the low charge per outlet fixed by the terms of our wiring offer is very little, and may be paid for in ten small monthly payments if desired. He wouldn't feel the outlay." "He owes you good light," continues the text in this bulletin —"electric light—just as much as he owes you good plumbing. You are at a disadvantage without either. The electric-lighted store always draws the trade. It looks brighter and cleaner, and on summer evenings it is not nearly so hot. If your landlord refuses to act, write us, giving his name and address, with a brief description of your premises. We'll go after him ourselves. The Illuminating Company." Reproduced herewith is a sample schedule for the wiring of such a store requiring ten outlets and indicating the method of calculating any similar installation of average size.

MASTER-SWITCH LIGHTING CIRCUITS

Methods of Wiring Outlets and Local Switches for Universal Control

BY V. N. HEATH

Master-switch circuits are now frequently specified for residence-wiring installations. Where they have not been specified by the architect the contractor can often induce the owner to install them if he explains their advantages. In this way it is often possible for a contractor to obtain a fair profit on an installation that otherwise would offer but meager returns.

As the term is generally understood, a master switch is a switch, usually placed in the owner's bedroom, by means of which the latter can light at will all of the lamps or certain designated lamps in his residence. This he can do regardless of the positions of other switches throughout the building controlling the same lamps.

There are really two classes of master switches. One

SCHEDULE

CLASSIFICATION OF LIGHTS

Location	Center Outlet	Side Outlet	Bar Receptacle	Drop Cord Key Sockets	Drop Cord Chain Sockets	Single Pole Switches	3-Way Switches	Snap Switches	4-Way Switch	Watts	Remarks
Sales Room	3							1			10 Outlets - 38.35 3 Key drop cords - each 50¢ - 1.50 2 Porcelain base switches each 30¢ - .60 Total - - - $40.45
Show Windows	2							1			
Stock Room				1							
Basement				1							
Lavatory				1							
Rear Hall											
Upper Hall											
Upper Rear Hall											
Office											
Show Case											
Store Fixtures											
Closets											
Outside Light											
Sign											
Totals	5			3				2			10 Outlets -

This can be paid
$10.15 down—$3.03 monthly

For information inquire of
THE ILLUMINATING COMPANY
ILLUMINATING BUILDING
PUBLIC SQUARE

PRICE LIST OF OUTLETS and HARDWARE

GENERAL:—All openings for switches, receptacles, drop cords and fixtures are considered as outlets and based on a Unit price for different classes of construction.

The cost of switches, receptacles and drop cords should be added to the price of outlets, and this sum will be the contract price for all labor and material necessary to complete the work as outlined in the schedule.

All extra outlets, switches, receptacles and drop cords will be charged for at the rates according to the class of wiring for which the contract is written.

OUTLETS

No. of Outlets	Concealed Work or Wood Molding	Metal Construction
5	$22.10	$30.85
6	25.35	35.85
7	28.60	40.85
8	31.85	45.85
9	35.10	50.85
10	38.35	55.85
11	41.00	60.25
12	43.65	64.65
13	46.30	69.05
14	48.95	73.45
15	53.00	77.85
16	54.25	82.25
17	56.90	86.65
18	59.55	91.05
19	62.20	95.45
20	64.85	99.85

HARDWARE

Panell board switches, each	$1.25
Push button switches, each	1.25
Push button 3-way switches, per pair	3.50
Push button 4-way switches	2.45
3-way snap switches, per pair	1.95
Porcelain base switches, each	.30
Porcelain base Edison receptacles, each	.30
Bryant flush plate receptacles, each	.80
Chapman flush plate receptacles, each	1.15
Drop cord key socket, each	.50
Drop cord chain socket, each	.75
Window wall socket, each	.50

SAMPLE SCHEDULES FOR WIRING SMALL STORES

may be termed the "single-control master switch." With a single-control switch the owner can light all the lamps on the master-switch circuits at will, but he cannot extinguish them by throwing the master switch if the lamps are turned on at their individual switches. A universal-control master switch is one whereby all of the lamps on the master-switch circuit can be lighted or extinguished at will. The circuits and wiring for the single-control arrangement have been adequately described, but little or no information has been published relative to universal-control master-switch circuits.

The elementary universal-control master-switch circuit is shown in Fig. 1. For a universal-control circuit two single-pole master switches M_1 and M_2, as shown in Fig. 1, are used in each branch circuit. That is, each pair of single-pole master switches can control a group of sockets not exceeding sixteen in number and requiring not more than 660 watts. If the installation in

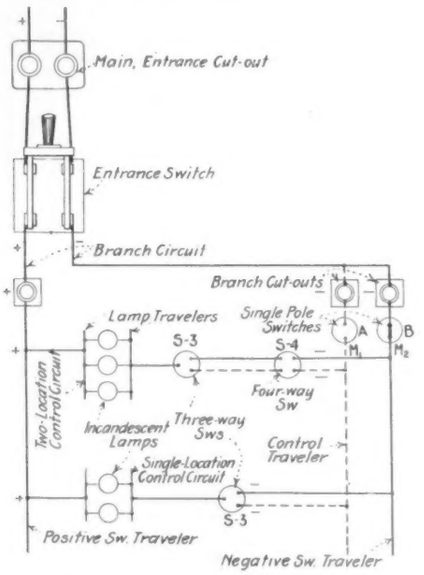


FIG. 1—ELEMENTARY UNIVERSAL-CONTROL MASTER-SWITCH CIRCUIT

question has a rating exceeding sixteen sockets or 660 watts, it will be necessary to install a set of branch cut-outs and one additional pair of single-pole master switches for each sixteen sockets or 660 watts, or portion thereof, so that the National Electrical Code requirements may be satisfied.

Switch M_1 is normally open, while switch M_2 is normally closed. Wherever there is a group of lamps to be controlled from one location a three-way switch such as that indicated at *S*-3 must be installed. Wherever a group of lamps is to be controlled from two locations, as, for example, for hall lighting, a four-way switch, *S*-4, must be installed in combination with a three-way switch. Where a group of lamps is controlled from more than two locations a three-way switch must be installed at the location nearest the group of lamps, and as many additional four-way switches must be installed as there are additional control locations, as suggested in Fig. 3.

With the circuit wired as shown in Fig. 1, if switch M_1 is closed, all of the lamps on the master-switch circuit are lighted regardless of the positions of the three-way and four-way switches throughout the building. If master-switch M_2 is opened, M_1 also remaining open, all of the lamps on the master-switch circuit will be extinguished. To restore the master-switch circuit to its normal condition, so that the lamps can be lighted or extinguished by their individual switches installed at different points in the residence, one master switch must be open and the other master switch must be closed.

It is seldom that a residence can be wired in exact accordance with the elementary circuit shown in Fig. 1, because this wiring diagram is drawn for only one

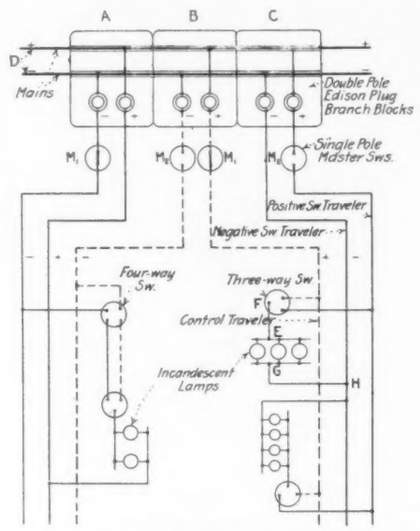


FIG. 2—UNIVERSAL-CONTROL MASTER-SWITCH WIRING WITH PLUG CUT-OUTS

branch circuit. In cases where the lamps are supplied with energy from more than one branch circuit and must be subject to master-switch control, the wiring becomes more complicated. The connections can be very readily made for any number of branch circuits, provided the wireman remembers and follows the few simple rules that will be given.

Fig. 2 shows the method of wiring for universal-control master-switch circuits where porcelain-base Edison plug cutouts or branch blocks are used. Two branch circuits are shown. One is fed through the cutout *A*,

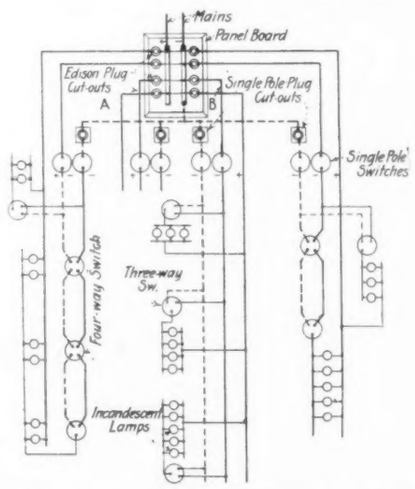


FIG. 3—UNIVERSAL-CONTROL MASTER-SWITCH WIRING FOR AN EXISTING PANEL-BOX INSTALLATION

and the other through *C*. The cutout *B* is placed to carry the fuses for the control travelers, shown in dotted lines in the diagram, for the two circuits.

In laying out and wiring these circuits it will be convenient to designate one leg of the main circuit the positive or + leg, and the other the negative or — leg, as shown at *D* in Fig. 2. These legs need not actually

be the positive and negative legs of the circuit, but these polarities are assigned to them arbitrarily merely to distinguish one side of the circuit from the other as an aid in tracing out connections. It will be noted from a study of Fig. 2 that each individual control switch, whether it be a three-way or a four-way switch, has one of its terminals connected to a control traveler, and another terminal connected with a switch traveler of the same polarity as the control traveler for the same switch. The suggestion just noted is the most important one, and if the wireman follows it closely he will have little difficulty in connecting his circuits.

One side of each group of lamps is always connected to the single terminal of a three-way switch, as shown at *E* and *F* in Fig. 2, while the other side of each group of lamps is connected always to a switch traveler of the opposite polarity to that of the control traveler, as shown at *G* and *H*.

The wiring scheme suggested in Fig. 2 can be extended to serve as many circuits as is necessary, provided that each branch control circuit does not contain more than sixteen sockets nor be loaded with more than 660 watts. There must be a pair of single-pole master switches for each branch circuit.

If there is any objection to a number of single-pole snap or flush switches for this control service, multi-bladed knife switches can be used instead. Each blade of such a knife switch would take the place of a single-pole flush or snap switch. For example, if there were three branch circuits in an installation, two triple-pole, single-throw knife switches would be installed. Each of the blades of one of these triple-pole switches would take the place of an M_1 switch, while each of the blades of the other triple-pole switch would serve in place of an M_2 switch. Where multi-blade knife switches are used as suggested the owner can light or extinguish all of the control-circuit lamps in his building by throwing the handle of one of these multi-blade switches.

The contractor may be called upon to install a universal-control master-switch circuit in a building that is already wired for electric lamps. Fig. 3 shows the circuits for such an installation where panel boxes have been installed. All of the control travelers can be fed from one side of the circuit, the negative side, for example, as shown in Fig. 3. Single-pole plug cutouts are used to protect the control travelers from excessive currents. These plug cutouts are most conveniently placed at some point adjacent to the panel-box location as outlined in Fig. 3. The dotted lines in Fig. 3 indicate the wires that must be added to an existing installation to provide the universal control-circuit feature. At each location where a single-pole switch was formerly used in the existing installation a three-way switch must be installed, as shown in Fig. 3. At certain points where three-way switches were formerly installed four-way switches must be placed as shown. At certain other points where there were formerly four-way switches the four-way switches are permitted to remain. Reference to Fig. 3 will make the meaning of this statement clear.

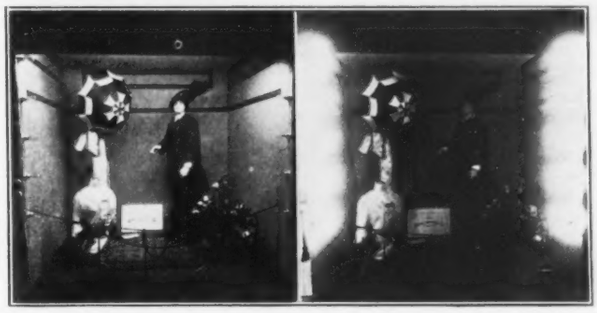
Where branch circuits are fed from a panel box the wireman may experience trouble in making the correct connections unless the suggestions previously given in regard to polarities are closely followed. It is frequently necessary to cross conductors, as shown at *A* and *B* in Fig. 3, to make these polarities correct. This crossing is necessary because of the method in which connections are often made to the branch circuits on the panelboard.

Inasmuch as master switches are usually installed in the owner's bedroom, it is best to install the panelboard in this room, or near it, so that the master switches will be near the distributing cabinet or panel box.

Lighting Practice

Educating Merchants in the Principles of Window Lighting

One of the educational displays used by the Alliance (Ohio) Gas & Power Company at an electric show consisted of a display window properly dressed and arranged to be lighted by two sets of lamps. One circuit of five 60-watt lamps was arranged in reflectors above

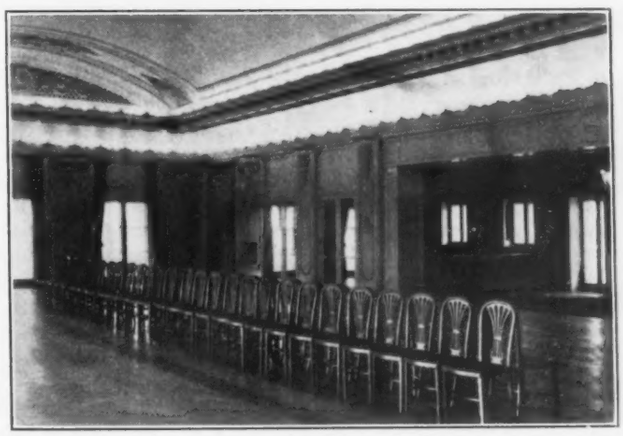


FIGS. 1 AND 2—EDUCATIONAL WINDOW DISPLAY

the window and the light rays were directed upon the objects in the window (Fig. 1). The other circuit, made up of ten 30-watt lamps, was run along either upright edge of the window, and when lighted the blinding effect of the light made it difficult for one to see the display. The pictures of this window shown herewith had exposures of identical length, and the wattage of the lamp installations was the same.

Elaborate Illumination in a Private Ballroom

The ballroom of the palatial home of the late Charles G. Gates on Lake-of-the-Isles Avenue, Minneapolis, Minn., illustrated herewith, has a decorative lighting equipment of 566 25-watt tungsten lamps and 236 8-cp carbon-filament lamps, concealed in the two cornices.



DOUBLE CORNICE LIGHTING IN BALL-ROOM OF PRIVATE HOUSE

These units are arranged in separate circuits of red, blue and yellow-dipped lamps, and are under the control of an elaborate dimmer mechanism by which the intensity of illumination can be closely controlled. As already noted in these columns, the Gates residence has a total connected lighting load of 91 kw and motors aggregating 80 hp. Service is supplied by the Minneapolis General Electric Company.

Illumination Systems for Good Lighting of Offices

By A. B. Oday and R. E. Harrington*

The progressive managers of offices and office buildings have long been cognizant of the fact that a system of artificial illumination so installed as to furnish adequate general light in all portions of a room is the most desirable from the standpoint of organization

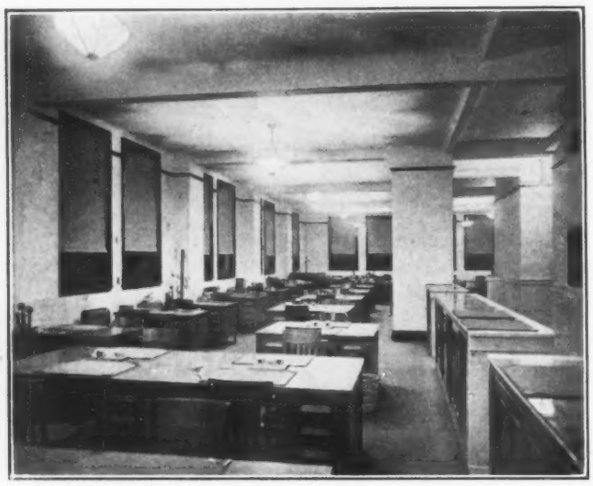


FIG. 1—NIGHT VIEW OF OFFICE EQUIPPED WITH SEMI-INDIRECT UNITS

efficiency. By the use of such a lighting system desk arrangement may be altered and departments moved as occasion demands without necessitating a corresponding change in the lighting equipment. It is a well-known fact that a great variation of illumination intensity throughout a room is detrimental from a visual standpoint, as it is necessary for the eye to accommodate itself to the various intensities. When individual desk lamps are used, without any general illumination, this condition is sure to exist, as nearly all of the light is concentrated in bright spots on the desk or table tops and the other portions of the room are in comparative darkness. When, however, general illumination is employed there is nearly even illumination in all portions, consequently eye strain due to variation in intensity is eliminated.

Individual desk lamps have been in vogue to some extent in the past, many believing them to represent the best lighting system to be obtained. The lighting units employed with this system were usually such as to leave glaring scurces in the range of the worker's eyes. As a result nearly all of the accompanying bad effects, such as eye strain, headache, depression and nervousness, were in evidence. Each time it became essential to install additional desks or change the old arrangement it was necessary to provide additional wiring so that light would be available for each person. This was expensive and often resulted in unsightly offices.

A properly designed lighting installation will prove economical by eliminating the deficiencies of the antiquated system just described. The modern system provides a moderate intensity of illumination in all portions of a room, there being no exceptionally dark or light areas, glaring light sources are not visible, and diffusion of the light is accomplished to a reasonable degree.

A particular installation representative of modern office lighting is that in the new offices of the Casualty Company of America, 68 William Street, New York City. These offices are lighted by semi-indirect illumination throughout, and, as shown by the night photographs, the illumination approaches the ideal in many respects. There is adequate illumination in all portions of every room, there are no objectionable shadows, the light is diffused to an agreeable degree of softness, the variation between minimum and maximum intensity is very small, and, last but not least, the fixtures are artistic in appearance as well as being efficient light distributers.

Fig. 1 is a night view of the underwriting department from an untouched photograph taken under the regular illumination. The illumination is supplied by 400-watt clear high-efficiency gas-filled tungsten lamps installed in semi-indirect lighting units. These units are spaced on centers about 17½ ft. apart and hung about 12 ft. above the floor. When illumination readings were taken in a typical bay of this room the average intensity on a plane 30 in. above the floor was found to be 5.4 ft.-candles With a consumption of 1.3 watts per square foot of floor area, the utilization was 4.15 effective lumens per watt.

In order that the entire lighting installation should present a harmonious appearance, the private offices were equipped with fixtures similar in design to those used in the general offices. Fig. 2 is a view of the private office of the secretary and treasurer. Illumination is supplied by one central ceiling fixture consisting of a 400-watt clear high-efficiency tungsten lamp in a semi-indirect unit.

Very satisfactory results are obtained in the bookkeeping department, where the illumination must be of the very best. Lamps and reflectors similar to those described for the other rooms are utilized to good advantage here. The consumption is about 1.5 watts per

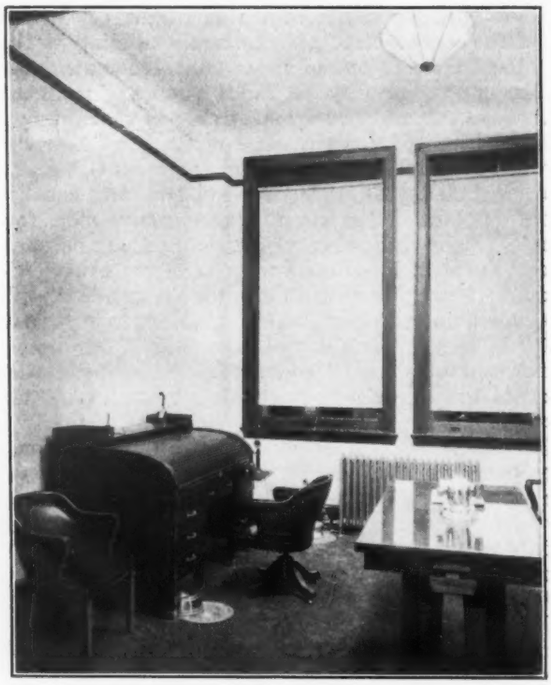


FIG. 2—PRIVATE OFFICE ILLUMINATED BY SINGLE FIXTURE

square foot of floor area, so that illumination of sufficiently high intensity is obtained for this very fine class of work.

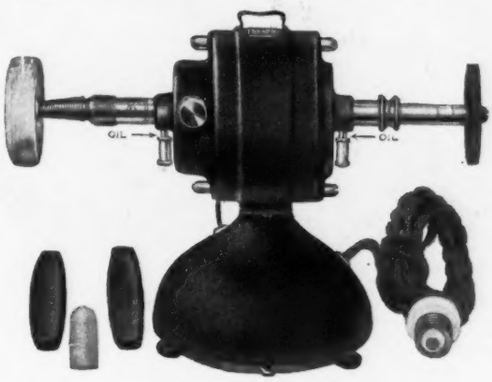
The lighting scheme throughout the various other portions of the offices is similar to that described above, the result being a very creditable example of modern office lighting.

*Edison Lamp Works of General Electric Company.

NEW APPARATUS AND APPLIANCES

General Utility Motors

The motor shown herewith is equipped with various kinds of attachments so that it can be used for sharpening knives, polishing silver and other metals, etc. A small pulley is provided as shown in the illustration for connecting a belt to small machines. By adding a

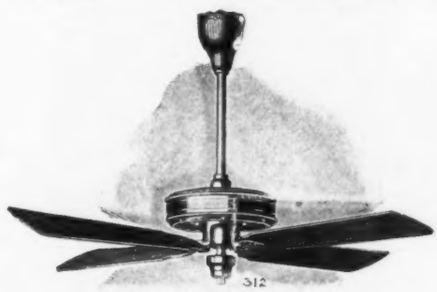


SMALL UTILITY MOTOR

flexible shaft to which the buff wheel can be transferred a portable outfit for polishing metal parts on automobiles, railings, signs, etc., can be obtained. The base of the motor is fitted with a two-speed starting switch. The motor is finished in black japan and is provided with brass trimmings. It is 8.5 in. high and the shaft is 7.25 in. long and 0.25 in. in diameter. The motor is equipped with 8 ft. of flexible cord and a separable plug, a 1.25-in. emery wheel for grinding and a 2.5-in. muslin wheel and a 2.5-in. canton-flannel wheel for polishing. Various kinds of extra parts can also be provided. The motor operates at 110 volts, and the complete weight of the outfit is 12.5 lb. It is being made by the Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York.

Alternating-Current Ceiling Fan

The ceiling fan shown in the accompanying illustration is operated by a self-starting induction motor, the field coils of which are attached to the laminated steel core and are thoroughly insulated from the core. The rotor is built up of sheet-steel laminations with copper

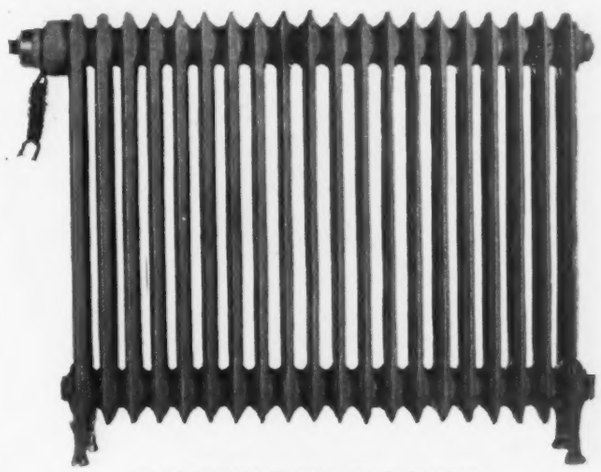


PLAIN-STYLE ALTERNATING-CURRENT CEILING FAN

conductors securely riveted to the copper end rings. Use is made of ball bearings which are immersed in oil. Oil is poured through a hole in the top of the motor body and passes to the lower oil chambers. A spiral groove in the bearing acts as a centrifugal pump when the fan is operating, thus circulating the oil along the shaft from the lower to the upper chamber. The fan has four blades which sweep through a space 54 in. in diameter. The length of each blade is 23.75 in., the width 5.5 in. at the shank end and 6.75 in. at the outer end. The blade shank is supported in a hub directly beneath the motor. The fan is equipped with a three-point, two-speed switch and regulator. The switch serves to start and stop the fan as well as to regulate its running speed. The fan is provided with a fixture box which has four holes for standard $\frac{3}{8}$-in. brass fixture-pipe connection, through which electrolier fittings can be attached if desired. It is designed for 110-volt and 220-volt, sixty-cycle service, and is of plain design. The fan is designated as style H and is being made by the Robbins & Myers Company, Springfield, Ohio.

Electrically Heated Radiator

An electric heating system consisting primarily of an ordinary radiator such as is used for hot-water heating, which is completely filled with an insulating circulating medium, and heating elements which are inserted through the bottom and the top of the radiator, has been placed on the market. The heating element is divided into several sections and is connected to a



ELECTRICALLY HEATED RADIATOR

multiple-pole switch which can either be attached directly to the radiator, as shown in the illustration, or placed at any convenient point desired. With such a system, it is claimed, the possibility of the heating element burning out or being damaged by oxidation is obviated. The consumption of energy based on a square foot of radiating surface is 30 watts to 35 watts on high heat, 15 watts on medium heat and 8 watts on low heat, giving a radiating temperature under normal weather conditions of approximately 200 deg. Fahr. on high heat. The amount of heat generated is controlled automatically by means of a thermostat. The heating system has been developed by Apfel & Jansen, 1626 Fourth Avenue, Seattle, Wash.

Copper-Base Alloy for Making Metal Die Castings

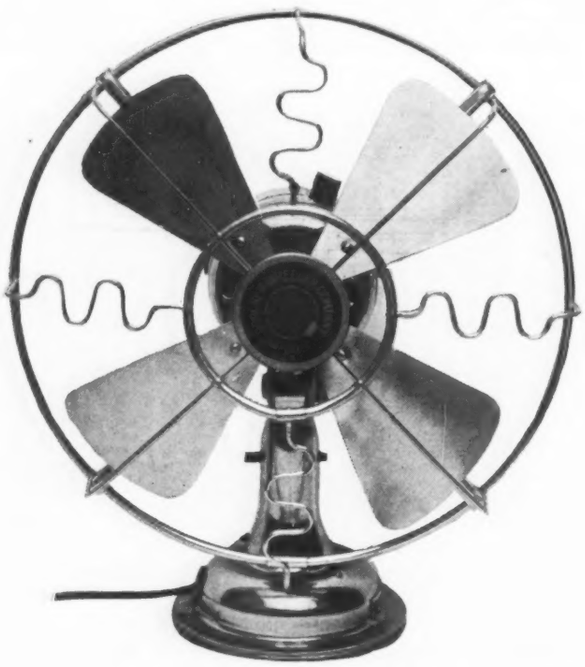
Tin, zinc, lead, aluminum and other white-metal alloys with small additions of copper have heretofore been used in metal die casting. But now a product known as "McGill metal," containing from 85 per cent to 95 per cent copper, has been placed on the market. Its

manufacturer, the McGill Metal Company, Valparaiso, Ind., states that the new alloy possesses all of the characteristics and properties of the best modern bronzes and has a tensile strength of from 75,000 lb. to 85,000 lb. per sq. in., with an elastic limit of from 30,000 lb. to 40,000 lb., an elongation of from 18 per cent to 23 per cent, and a reduction in area of from 17 per cent to 24 per cent on a 2-in. test length.

On account of the fact that small bevel gears, bearings, bushings and other irregularly shaped parts can be made more inexpensively from this alloy than from steel, and because the alloy possesses ability to withstand greater mechanical strains than white metals, the manufacturer believes that many parts of electrical machines can be die-cast which were formerly made by other processes.

Alternating-Current Fan

A new 9-in. alternating-current fan has been developed by the Crocker-Wheeler Company, Ampere, N. J., for the coming fan season. In place of moving a rheostat lever to secure different fixed speeds, speed control is obtained by rotating the core containing the



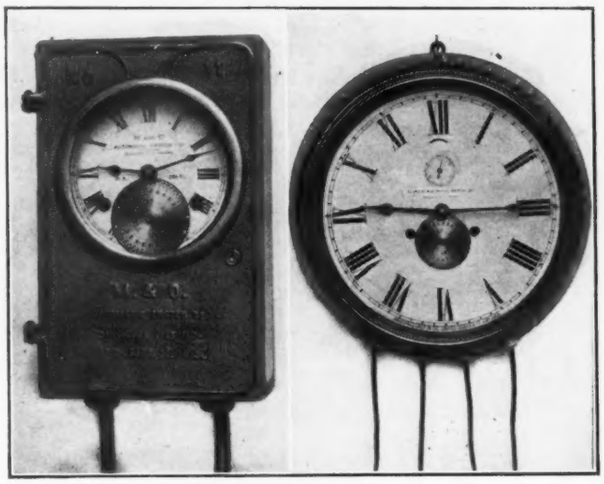
9-IN. ALTERNATING-CURRENT FAN

windings inside the fan housing. Not only can fine adjustment of speed be obtained, it is declared, but energy consumption varies with the speed. At full speed the fan takes 24 watts and at the lowest speed approximately 7 watts. The fan is started and stopped by means of a push switch located in the base, and it can be started and stopped at any speed at which it is fixed to run.

Automatic Time Switch with Clock Face

A time switch that may be used as an office or factory clock is being manufactured by the M and O Automatic Switch Company of Michigan City, Ind. One model (Fig. 1) has a 5-in. dial and has the timing and switching mechanism inclosed in a 7.5-in. by 11.5-in. by 3.75-in. cast-iron case finished in black japan and fitted with an oxidized-copper door. The other model (Fig. 2) is 15 in. in diameter and 3.75 in. deep and has a 12-in. dial. The case is of pressed steel trimmed in oxidized copper.

Both models are rated at 30 amp, 250 volts, the operating mechanism consisting of a Perkins two-pole snap

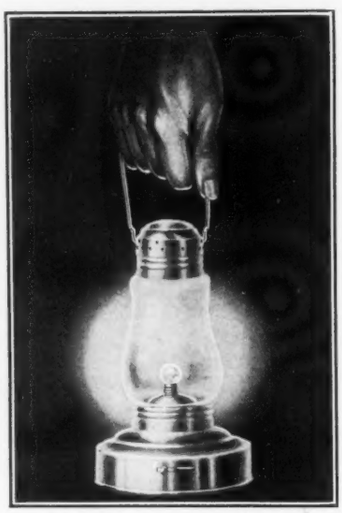


FIGS. 1 AND 2—TIME SWITCHES WITH CLOCK-DIAL FACES

switch driven by a Seth Thomas eight-day clock movement. One feature of the device which the makers have patented consists of a mechanical interlock to insure positive action of the switch. Circuits controlled by the switch can be operated as often as is desired, the time of operation being controlled by steel pegs placed in holes in the circumference of the graduated circular disk beneath the clock hands. The clock dial itself can be removed without taking the hands off the spindle by moving both hands into a position over the control disk and then lifting the clock face outward.

Electric Lantern

The battery-operated lantern shown herewith was recently placed on the market by the Beacon Miniature Electric Company, 118 Duane Street, New York. All



ELECTICALLY OPERATED LANTERN

metal parts of the device are nickel-plated. Use is made of a small tungsten lamp. The battery will operate for five hours on continuous service and ten hours on intermittent service.

Composition Sign Receptacle

A sign receptacle of asbestos composition material has just been placed on the market by the Best Electric Company, Pittsburgh, Pa. The receptacle is designed particularly for outdoor service, and the manufacturers

SIGN RECEPTACLE OF ASBESTOS COMPOSITION MATERIAL

claim that it will withstand the action of both fire and water. With the above composition material, uniformity in size is assured, it is declared, so that the spacing is always the same. The material will also have no tendency to crack. The nuts are molded into place and therefore cannot work loose. The interior screw shell is interchangeable, and its removal can be easily effected by turning back two screws.

Four-Arc Lamp

The "broadside" lamp shown herewith consists of a battery of four arc lamps in a single housing. The mechanism is of the clutch-feed type and use is made of a single solenoid for each pair of arc lamps. The mechanism is designed to operate on either direct current or alternating current and is so arranged that by the throw of a switch it may be used on either 110-volt or 220-volt circuits. The energy taken in either case is the same, because on 220 volts the four arc lamps are

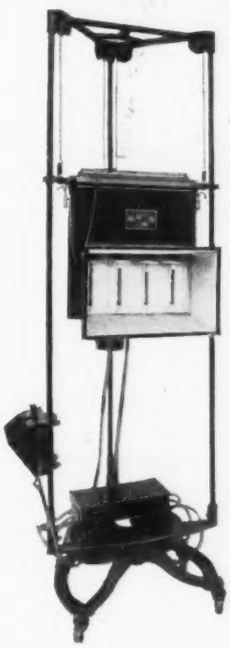


FIG. 1—FOUR-ARC LAMP FOR MOTION-PICTURE SERVICE

in series, taking 33 amp, and on 110 volts they are in multiple series and take 66 amp. The diagram shown in Fig. 2 illustrates how the operation can be changed from 110 volts to 220 volts by simply throwing the double-throw switch to either side. The electrodes are treated so that the light produced closely approximates daylight in value. The lamp is therefore especially valuable for photographic purposes. The lamp has been designed especially for motion-picture work. It is being

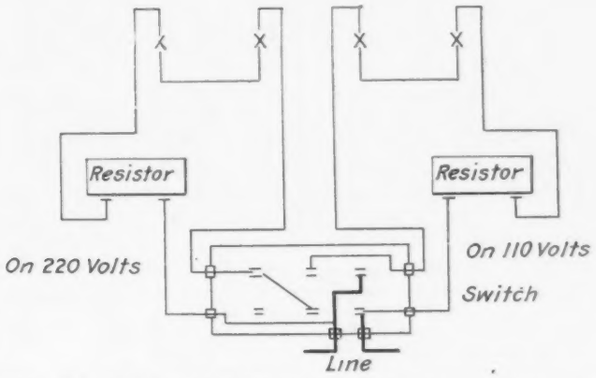


FIG. 2—WIRING DIAGRAM SHOWING CONNECTIONS FOR 220-VOLT AND 110-VOLT SERVICE

placed on the market by M. J. Wohl & Company, 211 Fulton Street, Brooklyn, N. Y.

Vacuum Cleaner with Wooden Pistol-Grip Handle

The vacuum cleaner shown herewith is provided with a push-button switch which is in the pistol-grip handle. The handle is detachable and self-adjusting and is of wood. The machine is so designed that the handle is automatically maintained in an upright position. It is operated by a General Electric universal motor. The machine is supported on three fiber rubber-tired wheels, the rear wheel being adjustable to raise or lower the suction nozzle. Use is made of a 12-in. nozzle and a revolving brush for picking up threads, hair, lint, etc.

LIGHT-WEIGHT VACUUM CLEANER

Both dirt bag and brush are detachable for cleaning purposes. The weight of the device is 10 lb. and the height is 7.5 in. An 8-ft. covered hose is utilized with special tools for cleaning draperies, pictures, mattresses, etc.

The hose is attached to the front of the cleaner nozzle. The vacuum cleaner is a low-priced machine and is being made by the Innovation Electric Company, 585 Hudson Street, New York.

Oil Transformer

The transformer illustrated herewith is a small self-contained device and is designed especially for service in residences, apartments, etc., for operating doorbells, annunciators, burglar alarms and door openers. It is adapted for use with sixty-cycle, 110-volt circuits, and reduces the potential to 12 volts for the bell circuit. The transformer is inclosed in a cast-iron case, the bottom of which is closed by a pressed-steel cover. Two cable leads for the lighting circuit come from one end of the case, and two brass studs for the bell circuit are at the opposite end of the case. Both the cable leads and the brass studs are held in bakelite bushings. The

SMALL TRANSFORMER FOR BELL CIRCUITS

core of the transformer is built up of punchings of transformer steel. The primary and secondary coils are wound independently and are highly insulated. According to the manufacturers, the transformer is so constructed that it will not burn out even though it is left to operate indefinitely on a short-circuit. The transformer is designed to ring three 4-in. bells connected in multiple. For use with 6-in. bells two transformers are necessary, the primaries being connected in multiple across the lighting circuits and the secondaries in series. Two transformers connected in this manner, the manufacturers assert, will operate three 6-in. bells at one time. The transformer is 6.5 in. high, 2.5 in. deep and 3.5 in. wide, and it weighs only 4.625 lb.

This instrument is being made by the Fort Wayne Electric Works of the General Electric Company, Fort Wayne, Ind.

Device for Receiving Wireless Time Signals

An "audion" time receiver has recently been placed on the market by the De Forest Radio Telephone & Telegraph Company, 101 Park Avenue, New York, for receiving the government signals, which are sent out twice a day, according to the explanation accompanying the diagrams shown in Fig. 2. The time signals are transmitted as shown in the diagram, being merely a series of dots one second apart for five minutes before 12 noon and before 10 p. m., ceasing on the twenty-ninth second of every minute and for the last five seconds on each of the first four minutes. They cease for the ten seconds at the end of the last minute, and a long dash is transmitted exactly on the hour, the time being taken at the beginning of the dash.

Besides the necessary tuning apparatus, an "audion" detector is inclosed in a waxed piano-finished oak case, 13 in. long, 11 in. wide and 11 in. high. All metal parts are heavily nickel-plated, and all switch and control knobs and binding posts are of hard rubber. The front panel is of black composition material. According to the manufacturers, when once the set is adjusted it

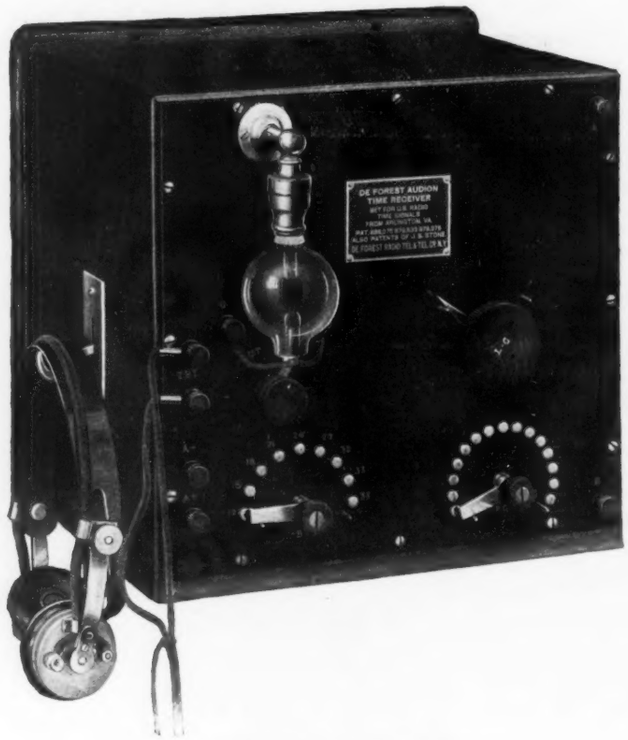


FIG. 1—RECEIVER FOR TIME SIGNALS

will remain so from one end of the year to the other. When one is through using the set, the head receivers are hung on the hook at the left, so that their weight pulls it down and automatically shuts off all circuits.

The wires running to the aerial through the lighting switch are connected to the binding post on the set marked *A*. The ground wire is connected to the binding post *E*. A 6-volt battery is connected to the binding posts marked *AA*, and the tips of the head set to the binding posts marked *TEL*. The wire leading out from the grid in the bulb is connected to the binding post *G* and the wire from the wing in the bulb to the binding post *R*.

At five minutes before the hours on which the time signals are sent, Eastern time, the head set is lifted off the hook and the bulb is immediately lighted. The rheostat knob under the lamp socket is turned away from "in" toward "out," until the filament of the bulb

becomes normally bright. The switch *B* is started at the lowest point No. 12, and is turned to the right until a blue discharge occurs in the bulb or a hissing noise occurs in the receivers. The switch is then brought back one point at once, as the blue discharge, if prolonged, is detrimental to the bulb. The knob *PC* is now moved from the lowest left-hand contact point around the arc, and at the same time the knob *LC* is moved slowly until the high-pitched time signals come in loudest. When this occurs the set is in "tune" with the government station. If other signals interfere with the time signals, the knob *LC* or *VC* is turned to the left to reduce the interfering signals. The switch knob *PC* is also adjusted slightly.

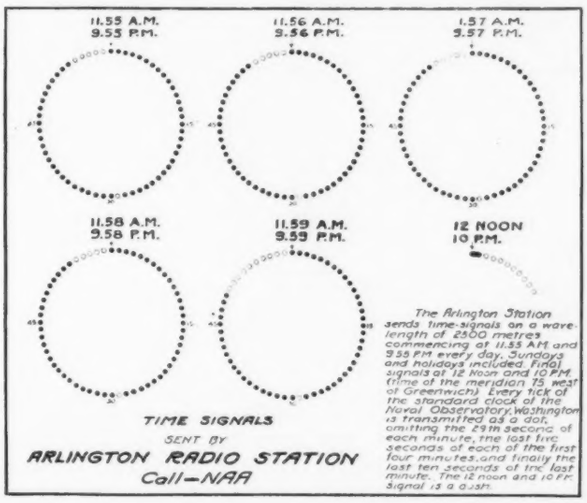
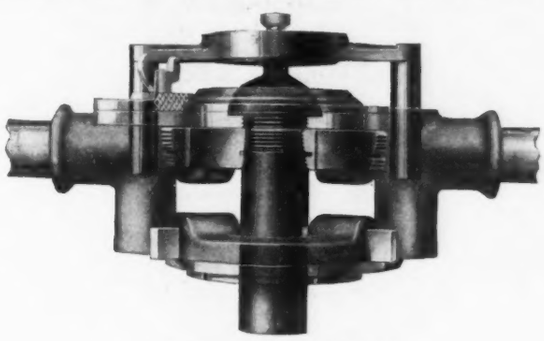

11.55 A.M.
9.55 P.M.
11.56 A.M.
9.56 P.M.
11.57 A.M.
9.57 P.M.
11.58 A.M.
9.58 P.M.
11.59 A.M.
9.59 P.M.
12 NOON
10 P.M.
The Arlington Station sends time-signals on a wave-length of 2500 metres commencing at 11.55 A.M. and 9.55 P.M. every day, Sundays and holidays included. Final signals at 12 noon and 10 P.M. (time of the meridian 15 west of Greenwich). Every tick of the standard clock of the Naval Observatory, Washington is transmitted as a dot, omitting the 29th second of each minute, the last five seconds of each of the first four minutes, and finally the last ten seconds of the last minute. The 12 noon and 10 P.M. signal is a dash.
TIME SIGNALS
SENT BY
ARLINGTON RADIO STATION
Call—NAA

FIG. 2—DIAGRAM SHOWING METHODS OF SENDING WIRELESS TIME SIGNALS

Tool for Cutting Threads

A cross-bar die stock, as it is called, for threading pipes with diameters varying from 0.5 in. to 1.25 in. has just been developed by the Borden Company, Warren, Ohio. A bar extends across the top of the tool and carries a plug which rests on the end of the pipe. Two sets of dies are utilized, the lower set being employed to begin the thread with a rough cut and the upper set to finish the thread. While starting the thread the lower dies are stationary, but as soon as the upper dies begin to cut the lower dies are gradually withdrawn until they no longer touch the pipe. The upper dies are narrow, and as they advance along the thread, cut less and less. In starting a swiveled plug extends down between the dies to the bottom of the upper section. When the work of the lower dies is completed the pipe end comes in contact with the swiveled plug, raising it as the second set of dies start to cut the thread. The raising of the plug causes the side posts to be lifted, and the die cam is turned and gradually causes the dies to recede, thus giving a tapered thread. The dies are set by means of the handle shown in the illustration. A universal guide is utilized to center the pipe. Double-ended dies are employed with the tool, which is called by the manufacturers a "Beaver" die stock.



CROSS-BAR DIE STOCK

Large-Sized Generator for Gas-Steam Set

Four large direct-current generators are now being installed in the Detroit plant of the Ford Motor Company which were built by the Crocker-Wheeler Company, Ampere, N. J. Each of these machines will be directly connected to a two-cylinder tandem gas engine and a compound condensing steam engine, as described in the ELECTRICAL WORLD of Sept. 12, 1914, page 528. The combination gas-engine and steam set was made by the Hoovens, Owens, Rentschler Company, Hamilton, Ohio.

The maximum diameter of the generator shaft is 34 in., it is 26 ft. long and weighs approximately 35 tons. The greatest diameter of the armature is 15 ft. 10 in., and its total weight is 42.5 tons. The armature spider is of cast iron and is cast in two parts, each part weighing about 9 tons. Eight bolts are used to hold the spider halves together, each bolt weighing 500 lb. and each fluted nut, of which there are sixteen, weighing 90 lb. In order to obtain the proper tension on the bolts each bolt was heated before being placed in position so that on cooling after the nuts had been tightened the bolt contracted and drew the two halves of the spider together with great force. The laminated core consists of 26,000 separate parts, each part having to be handled separately during the process of assembling. There are 10,000 core laminations and 5600 core ventilators. The commutator is made up of 630 copper bars insulated from each other and assembled on a cast-iron spider frame. The spider frame is also made in two parts, each weighing 5000 lb. The diameter of the commutator over the bars is 9 ft. 2 in., and its total weight is 10 tons, of which 4 tons is copper. The completed armature mounted on the shaft is supported on two bearings, each being 33 in. in diameter and 5 ft. long.

FRAME OF DIRECT-CURRENT GENERATOR FOR FORD PLANT

The magnet frame is of cast iron and has a section

resembling an enlarged T-rail section. Like the other large castings, it was cast in two parts, each weighing 20 tons. The outside diameter of the frame is 22 ft. 2 in., and the distance across the base 25 ft. 8 in. Thirty main poles and thirty interpoles were bolted to the inside of the frame after the field coils were in place. The rocker ring to which the brush-holders are fastened is supported by brackets cast on the side of the magnet frame. The rocker ring is of cast iron and has an outside diameter of 20 ft. It weighs 4 tons. The machine is equipped with 240 brushes.

The total weight of generator, including shaft, is about 135 tons, of which 13 tons is copper. At 250 volts the generator is rated at 15,000 amp. The normal rating of the machine is 3750 kw and the maximum rating is 4500 kw. The generator operates at a speed of 80 r.p.m., which gives a peripheral velocity of the armature of about a mile a minute. It was necessary to split the large castings in order to meet railroad-tunnel clearances.

Electrically Operated 8-In. Fan

An 8-in. fan which operates on 8-volt to 120-volt alternating current is being made by the Lindstrom, Smith Company, 1100 South Wabash Avenue, Chicago,

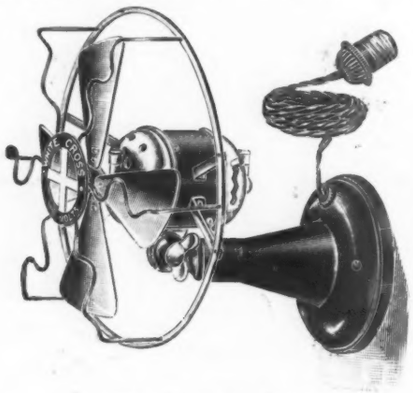


FIG. 1—WALL FAN

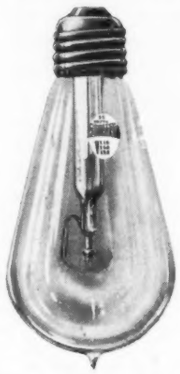
Ill., in both the desk and wall type. The wall fan has a large wing nut adjustment which allows the fan to be turned at any desired angle. The guard is of

FIG. 2—DESK FAN

heavy drawn brass and the blades of bright brass. The desk fan is shown in Fig. 2 and is provided with rubber feet so that it will not mar polished or finished surfaces. The weight of each fan is 6 lb. The desk fan is 12 in. high and 9 in. wide. The wall fan extends out 9 in.

Concentrated-Filament Tungsten Lamp

A vacuum lamp with a concentrated or umbrella-type tungsten filament is shown in the accompanying illustration. The lamp is being made with ratings of from 10 watts to 400 watts. Standard straight bulbs are used

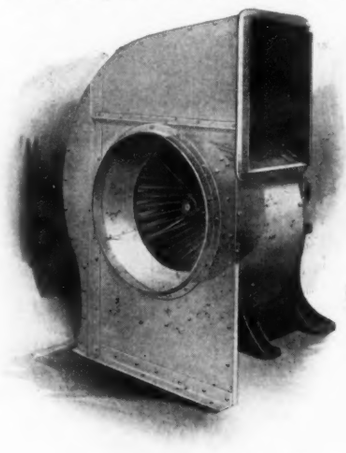


VACUUM LAMP WITH FILAMENT OF UMBRELLA TYPE

with all sizes except the 400-watt size, which is globular, the bulb being designated as type G-56. The lamp has recently been developed by the Independent Lamp & Wire Company, 1733 Broadway, New York.

Multiblade Fan

The fan shown herewith is called a conoidal fan because of the prevalence of conical shapes and surfaces in its design. There is a cone inlet in the housing; the individual blades are sections of conical surfaces, and both inner and outer edges of the blades form frustums of cones. The blades are narrow at the top and increase in width toward the back. The hub is conical and deflects the air toward the blades without an abrupt change in direction. The blast wheel is equipped with thirty-two forward curved blades, which are riveted at the front or inlet end to a conical flange and at the back to an extra heavy boiler-plate disk or back plate. Four forged tie-rods are screwed into the hub and are attached to the conical flange at the inlet edge of the wheel. The housing is of heavy steel plate and is mounted on a heavy angle-iron base which is drilled for holding-down bolts. The inner edge of



"CONOIDAL" FAN

the outlet opening is approximately tangential to the periphery of the wheel, and the height of the outlet is approximately equal to the wheel diameter. The "Niagara conoidal" fan, as it is called, is being manufactured by the Buffalo Forge Company, Buffalo, N. Y.

CURRENT NEWS SECTION

Underwriters Passive on Concentric Wiring and Refillable Fuses

On the recommendation of its electrical committee the National Fire Protection Association at its biennial meeting in New York on March 24 and 25 did not recognize the principle of refillable fuses or take definite action for or against grounded concentric-wiring systems.

The electrical committee met earlier in the week to consider reports of standing committees on the National Electrical Code and to pass on other suggested changes. Whatever action was taken was reported in the open sessions held on Wednesday and Thursday, and owing to the widespread interest in many of the subjects coming up for consideration the meetings were very well attended.

Considerable discussion arose over the subject of refillable fuses, some delegates arguing that refillable fuses increased the fire hazard when used indiscriminately by persons unskilled in the art, while others contended that owing to the ease with which proper fillers can be secured and inserted, refillable fuses lessen the likelihood of persons resorting to other means of bridging the gap caused by a blown fuse. The electrical committee reported that in its opinion, experience has not yet shown that fuses in which the fuse element is intended to be replaced or renewed by the user are satisfactory in test or in field service to a degree warranting the recognition of the principle of refillable fuses in the rules of the National Electrical Code. The committee was sustained in its recommendation.

The committee on grounded concentric-wiring systems, in view of the great diversity of opinion on the subject and the apparent unfamiliarity of the electrical industry with concentric wiring, substituted an abbreviated report in place of the long list of recommendations printed in the bulletin issued before the meeting and outlined in these pages some time ago. Progress has been made in its investigations, it said, and it requested that it be continued for further investigation of the subject.

A committee of manufacturers, jobbers and electrical contractors presented a resolution to the Underwriters' committee asking that it require all informants to present in writing their statements for or against concentric wiring, and that a committee of technical and business experts appointed by the manufacturing interests to investigate the subject be permitted to see these statements. It also requested that the Underwriters decline to countenance oral discussion of the subject of concentric wiring before any of their official meetings so as to aid this committee of technical and business experts in obtaining correct conclusions on the large problems submitted to it, the Underwriters reserving to themselves, after the committee's findings have been published or its endeavors have been futile, the right to use the written statements in their possession. It was also suggested by the manufacturing and jobbing interests that the Underwriters request the committee of technical and business experts to solicit the thorough co-operation of the Underwriters' Laboratories, Inc., the body from which the Underwriters have been accustomed to obtain authoritative advice before approving either installation rules or rules governing the kind and quality of electrical apparatus, devices and appliances which are to be declared satisfactory to the National Board of Fire Underwriters.

The Underwriters' committee requested the committee of technical and business experts to co-operate with it. Action taken on other reports and suggested changes will be given in next week's issue.

Meeting of Manufacturers of Electrical Supplies

The board of governors of the newly organized Associated Manufacturers of Electrical Supplies met at the Hotel Biltmore, New York, on Wednesday night of this week and authorized the formation of the conduit section of the association, which organization was subsequently perfected by the adoption of by-laws and the appointment of officers and committees. Messrs. Gerard Swope, Western Electric Company, New York, and E. Morse, Simplex Electric Heating Company, Cambridge, Mass., were unable to serve on the board of governors of the new organization and tendered their resignations. A committee of the board will present the names of two others to fill the vacancies.

Four appointments were made to the membership committee so as to enable work in that direction to be undertaken at once. The chairman of the committee is Mr. W. C. Robinson, National Metal Molding Company, Pittsburgh, and the other appointees are Messrs. H. T. Paiste, H. T. Paiste Company, Philadelphia; Oscar Hoppe, American Circular Loom Company, Boston, and W. D. Steele, Benjamin Electric Manufacturing Company, Chicago. A canvassing committee is also in process of formation whose function it will be to give to all of the manufacturing interests of the country information relative to the organization and functions of the association, including its constitution and by-laws.

Plans have been set afoot with a view to co-operating actively with the other national bodies, such as the National Electric Light Association, the American Institute of Electrical Engineers, the Electrical Supply Jobbers' Association and the National Electric Contractors' Association, on matters of standardization involving manufactured products.

The chairman of the new conduit section is Mr. F. C. Hodkinson, Safety Armorite Conduit Company, Pittsburgh. The executive committee comprises Messrs. C. E. Corrigan, National Metal Molding Company, Pittsburgh; Oscar Hoppe, American Circular Loom Company, Boston; R. Dart, Alphaduct Company, Jersey City, and J. H. Trumbull, Trumbull Electric Manufacturing Company, Plainville, Conn. Mr. A. Laughlin, Central Tube Company, Pittsburgh, is secretary of the section, and Mr. Hays Murphy, American Conduit Manufacturing Company, Pittsburgh, is treasurer.

A meeting of electric wire and cable manufacturers will be called on the afternoon of April 14 at the Hotel Biltmore, New York, for the purpose of forming a wire and cable section. Mr. LeRoy Clark, Safety Insulated Wire & Cable Company, 114 Liberty Street, New York, is a committee of one to whom requests for information should be addressed. Invitations have been sent to all manufacturers of wire to join in the movement.

Meeting of "National Electrical Week" Committee

A meeting of the executive committee on the proposed "national electrical week" was held on March 24 at the Railroad Club, New York City. Mr. Anson W. Burchard, vice-president General Electric Company, who was in the chair, will continue to act as permanent chairman of the executive committee.

While decision as to the exact name to be given to "national electrical week" was postponed, the date was fixed as the week including Dec. 1, 1915, the opening day probably to be Nov. 27. The indications were that the entire electrical industry of the United States would lend its co-operation in forwarding the plans for the week.

In connection with the management of the week the following resolution was passed:

"Resolved, that under the general guidance of this committee the full responsibility for conduct of the electrical week be and is placed upon the general manager and staff of the Society for Electrical Development. It is understood that the general manager will call upon various individuals to act in an advisory capacity to the general manager and his staff."

Next week the committee will name the local committees for different cities in geographical centers. Fifty of the most prominent men representing different interests in the industry will act. A special meeting of the executive committee has been called for April 7 to consider the budget to carry on the work.

A. I. E. E. Industrial Power Meeting at Cleveland

At the 306th meeting of the American Institute of Electrical Engineers, held at the Hollenden Hotel in Cleveland, Ohio, March 18 and 19, under the auspices of the Cleveland Section the registered attendance was more than 300. At a noonday luncheon in the permanent quarters of the Electrical League of Cleveland, President P. M. Lincoln, Pittsburgh, Pa., and Mr. S. G. McMeen, Columbus, Ohio, addressed the assembled Jovian convention delegates and guests, who filled the league's commodious rooms. The speakers at the convention banquet were President Lincoln, Dr. C. S. Howe of Cleveland, Mr. S. G. McMeen of Columbus, and Mr. D. B. Rushmore of Schenectady, N. Y. Mr. H. J. Davis of Cleveland was toastmaster.

Abstracts of part of the papers and discussions are given below.

Factors Involved in Motor Application

A list of factors involved in motor applications and intended as an introduction to a discussion on the individual features concerned was presented by Dr. D. B. Rushmore. The paper was similar to but not so elaborate as the one he presented at the annual meeting of the American Institute of Electrical Engineers in New York City.

Discussion

The discussion of Mr. Rushmore's paper consisted almost entirely of written contributions covering motor applications in different industries. Mr. A. P. Lewis of Akron, Ohio, described very completely the motor drives in rubber mills. Mr. R. H. McLain read a paper on friction drives written by Mr. C. W. Larson of Erie, Pa. Five discussions dwelt on the necessity of taking safety precautions when making motor applications in gaseous mines and other dangerous places. The authors of these discussions were Messrs. C. W. Larson of Erie, Pa. W. C. Yates and William Baum of Schenectady, N. Y., C. A. Austin of New York, and H. H. Clark of Pittsburgh, Pa. Others who took part in the discussion were Messrs. F. A. Altney of Baltimore, Md., Harold Goodwin, Jr., and C. R. Weiss of Philadelphia, Pa., R. W. Davis of Milwaukee, Wis., H. L. Wallau and Howard Dingle of Cleveland, and O. W. Averrett and C. Fair of Schenectady.

Comparison of Squirrel-Cage and Wound-Rotor Motors

Performance characteristics of wound-rotor and squirrel-cage motors were compared in a paper entitled "Line Disturbance Caused by Special Squirrel-Cage and Wound-Rotor Motors When Starting Elevators and Hoists," by Mr. J. C. Lincoln. It was pointed out that the running efficiency of one two-and-one-half-year-old elevator equipment tested was about 32.5 per cent and

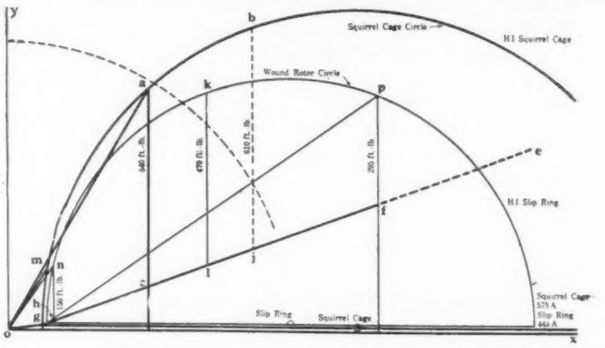


FIG. 1—CHARACTERISTICS OF HIGH-RESISTANCE SQUIRREL-CAGE MOTOR AND WOUND-ROTOR MOTOR HAVING NEXT LARGER FRAME

starting efficiency only 16 per cent. A Heyland circle diagram was employed to show graphically the currents required by wound-rotor and squirrel-cage induction motors to produce a given torque, the maximum torque that the motor is capable of producing, and the power-factor under different conditions.

It was shown that if the same maximum torques are exerted by both types of motors, larger starting currents are required by the wound-rotor motor than by

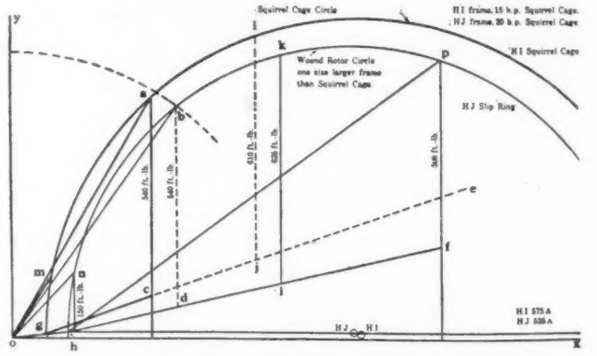

Squirrel Cage Circle
H1 frame, 15 h.p. Squirrel Cage.
HJ frame, 20 h.p. Squirrel Cage
H1 Squirrel Cage
Wound Rotor Circle one size larger frame than Squirrel Cage
HJ Slip Ring
H1 575 A
HJ 838 A

FIG. 2—CHARACTERISTICS OF WOUND-ROTOR MOTOR AND HIGH-RESISTANCE SQUIRREL-CAGE MOTOR HAVING SAME STATOR WINDINGS

the squirrel-cage type, and these currents are taken from the supply lines at lower power-factors. A similar relation exists even when ordinary loads have to be lifted. In order that a wound-rotor motor may start with less current than special squirrel-cage motors under any circumstances, a controller must be provided which will cut out each step of the resistance in approximately equal time intervals. This is best accomplished by means of dash-pots, but they are subject to many troubles. Use of special squirrel-cage motors for slow-speed hoists will eliminate considerable of the initial cost, maintenance and operating expenses involved with wound-rotor motors.

The consensus of opinion of the delegates discussing Mr. Lincoln's paper seemed to be that in sizes up to 15 hp or 20 hp the properly designed squirrel-cage motor has many advantages over other types for low-speed work. But for heavier duty at high speeds the characteristics of wound-rotor machines make them more nearly suited to the task and insure therefore less disturbance to distributing systems upon which the motors are operating. Those who participated in the discussion were Messrs. H. D. James of Pittsburgh, R. H. McLain of Schenectady and H. L. Wallau of Cleveland.

Abstracts of the other papers will be presented in a later issue.

Electrical Supply Jobbers at Chicago

Principal interest at the convention of the Electrical Supply Jobbers' Association at Chicago last week centered in the joint meeting with the manufacturers on Thursday morning. Although it had been understood in some quarters that this would be an "open" meeting, the session was held behind closed doors and admission was refused to persons not provided with special cards of invitation.

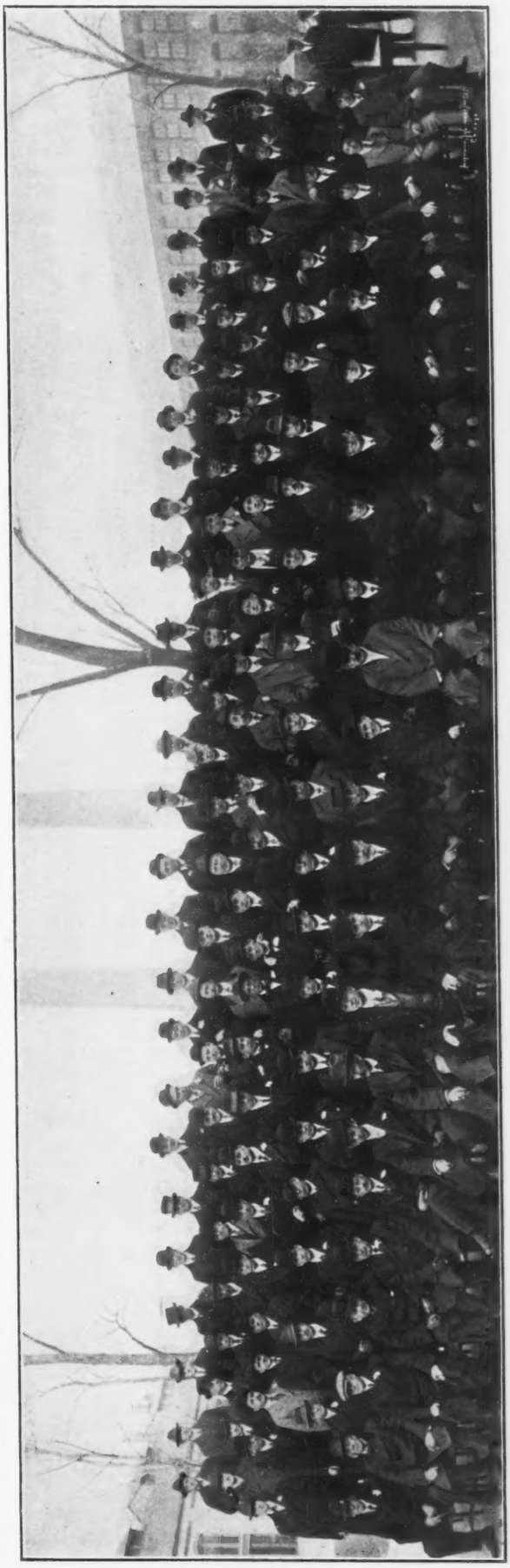
Two addresses written from the standpoint of the electrical manufacturer were read at the morning joint session. These held the close interest and attention of the 300 jobbers and manufacturers present. Mr. John C. Bridgman, of the Hazard Manufacturing Company, Wilkes-Barre, Pa., discussed "Difficulties in Marketing Goods," and Mr. H. B. Crouse, Crouse-Hinds Company, Syracuse, N. Y., spoke on the topic "Having a Policy." "Relations Between the Producer and Distributer" were discussed by Messrs. F. S. Price of the Pettingell-Andrews Company, Boston, Mass., Mr. W. W. Low, Electric Appliance Company, Chicago, and Mr. T. M. Debevoise, general counsel for the jobbers' association.

At the afternoon session of the jobbers, Mr. W. N. Matthews, of W. N. Matthews & Brother, St. Louis, Mo., presented a paper in which he recommended that electrical-supply jobbers follow the policy of other progressive merchandising firms in guaranteeing their goods on a money-back basis. Mr. A. F. Sheldon, of the Area (Ill.) Institute of Business Technology, spoke on "The Philosophy and Ethics of Industry."

The question of admitting representatives of the electrical press to sessions of future conventions was brought up at the meeting of Friday morning, and it was voted to admit electrical-newspaper men to the convention hall hereafter, at the discretion of the general secretary of the association.

Concentric-wiring topics came up for a brief discussion at one of the routine sessions of the convention, when Mr. Franklin Overbagh, general secretary, described for the benefit of members present the proposed innovation in wiring construction. Official action was taken by the jobbers in approving the resolution passed by the convention of electrical manufacturers at the Hotel Biltmore, New York City, March 9, referring the subject of concentric wiring to an expert committee of fifteen (see ELECTRICAL WORLD, March 13, page 694).

At the close of the brief session of Friday morning the members of the jobbers' convention were taken by a special elevated-railway train to the Hawthorne works of the Western Electric Company, where luncheon was served. The employees' band played during the meal, and at its close there were brief addresses by Mr. Gerard Swope, vice-president and sales manager; Mr. H. F. Albright, manager of works, and Mr. E. W. Rockafellow, assistant sales manager. Mr. Frederick P. Vose responded for the guests. The cable plant, stockrooms and telephone plant were visited on a tour of inspection through the works.



ELECTRICAL SUPPLY JOBBERS' ASSOCIATION AT HAWTHORNE WORKS, WESTERN ELECTRIC COMPANY, MARCH 19, 1915

Convention of Electrical Inspectors

The convention of the National Association of Electrical Inspectors was held at the Hotel Martinique, New York, on March 23, with an attendance of forty-five, the largest in the history of the association. President T. H. Day in his address stated that there are now six sections of the association and that the section plan should be greatly extended. Mr. Day deemed it advisable to change the articles of the association so as to permit of a foreign membership, in order for the association to obtain first-hand information on various European wiring and inspection practices. The absence of any information on the experiences of electrical inspectors in foreign countries with concentric wire was quoted to show that the association is losing by not having a foreign membership. This suggestion was acted on favorably at a late session.

The report of the secretary showed almost a 200 per cent increase in membership during the past two years, or an increase from 101 members on April 1, 1913, to 278 members at the present time.

The following officers were elected to serve for the next two years: President, Mr. H. S. Wynkoop, New York; vice-president, Mr. Washington Devereux, Philadelphia; secretary-treasurer, Mr. W. L. Smith, Concord, Mass., and representative on the electrical committee of the National Fire Protection Association, Mr. R. C. Strong, New Orleans.

Discussions of Proposed Changes in the Code

The latter part of the morning session and the greater part of the afternoon session were devoted to a discussion of the committee reports and suggestions for changes in the National Electrical Code embodied in the preliminary bulletin of the electrical committee of the National Fire Protection Association. On the request of Mr. G. L. Tollison, a discussion was held on the report of the committee on grounded concentric-wiring systems. The sense of the meeting was that absence of complete information regarding concentric wiring practices in foreign countries prevented an intelligent consideration of the proposal to introduce such wire in America. Possible lack of security of ground connections for such systems was one of the greatest objections raised to the introduction of such a system. The association went on record as being in favor of the report of the committee, namely, that at this time it did not recommend any rules for concentric wiring to be included in the code.

The association as a whole also went on record as approving the recommendations of its executive committee that Rule 32, Section B, of the code be revised so as to permit flexible cord to be used in show windows for temporary displays under special permission in writing. The same action was taken in regard to the addition to Rule 12, Section B, to the effect that the service loop from pole to building may be run with cabled wire provided that all wires in the cable are of equal cross-section and covered with approved rubber insulation, and provided that special permission be given in writing for the arrangement.

Protection of Polyphase and Split-Phase Induction Motors in Remote Locations

A very interesting discussion was called for on the suggestion of Mr. Morris Podell that provision be made in the code for requiring some device to open all phases of a polyphase induction motor or all connections to split-phase induction motors in case one phase or wire of a circuit is opened from any cause. This was suggested as advisable only in the case of motors which are out of sight or so situated that they receive little or no attention while running. Mr. Podell gave examples of a number of cases where motors situated in attics, cellars, etc., and controlled from other parts of the building had burned out and caused considerable damage owing to the blowing of one fuse, the others remaining intact.

Mr. Day maintained that the present code rules make it possible for an inspector to insist on such protection. However, the sense of the meeting was that no definite authority is given in the code for such an attitude on the part of the inspector. A committee—Messrs. W. L. Smith, O. E. Smith and M. Podell—was appointed to consider this suggestion, and if necessary to suggest a rule which will cover the points under discussion.

Banquet

In the evening a banquet was held in the "Oak Room" of the Hotel Martinique, Mr. J. C. Forsythe, of New York, acting as toastmaster. Those who spoke were Messrs. T. H. Day, H. S. Wynkoop, T. I. Jones, W. L. Smith, J. E. Latta, C. Roulet and G. E. Bruen. As a token of esteem and appreciation of the work of Mr. J. E. Cole, Boston, the association's representative on the electrical committee of the National Fire Protection Association, it was decided to petition that association to retain Mr. Cole on its electrical committee in some capacity that would require less of his time than heretofore.

President-elect Wynkoop's address considered mainly the value of an international membership and co-operation throughout the association. Mr. T. I. Jones pointed out the necessity for cheaper methods of wiring than those in existence to-day, stating that the proposed concentric-wire system was one that central stations in general thought worthy of the serious consideration of the various electrical interests.

Mr. Forsythe also spoke on concentric wiring and said that he had viewed models of fittings for a proposed concentric-wiring system and deemed them as good as any standard fittings on the market to-day for existing systems from the viewpoint of hazards. Many of the objections to the introduction of this system of wiring he believes to be "psychological," owing mainly to the fact that American engineers are not accustomed to bare-copper conductors.

Mr. Latta spoke on the value of the National Electrical Code and stated that the Underwriters' Laboratories were willing to do anything to advance the electrical industry provided that such things can be done with safety.

The banquet concluded the convention of this association proper, the members attending the meetings of the National Fire Protection Association on the following days.

Failure of Patent Office Legislation

The proposed Patent Office legislation failed of passage at the last session of Congress. The House of Representatives passed the bill which provided for the increase in numbers of and pay of examiners. With much other legislation the bill was delayed in the Senate by the long fight over the ship-purchase bill. During the concluding all-night sessions of Congress, in the early morning hours of March 4, the Senate passed the bill, but in some mysterious manner it was lost on its way to the enrolling clerk, and it was consequently never presented to President Wilson for signature. The result is that the bill has failed, although there was practically no opposition to it. It has been recognized in Washington that the measure was needed for the promotion of the efficiency of the Patent Office.

Patents Involved in Shoe Machinery Decision

In the decision last week of the United States District Court at Boston, dismissing the federal suit against the United Shoe Machinery Company under the Sherman act an extended discussion of the patent situation by Judge Dodge was an important part. Judge Dodge points out that the combination of constituent concerns was not unlawful so far as it did no more than put different groups of non-competing patented machines into one control (U. S. vs. Winslow, 227 U. S., 202). The combination was on its face simply an effort after greater efficiency, and the legality of such combination is fully recognized.

The government claimed that in 1899 the component companies were manufacturing their respective machines and parts under patents, that "many of the basic patents on the principal machines were about to expire," that their manufacture and use were about to become open to the public "in the near future," and that the defendants, not being satisfied with the rights enjoyed under the patents and intending to expand and perpetuate them to public detriment, devised the alleged monopoly. These allegations are not proved, and Judge Dodge holds that no such motive is shown to have prompted either the company's organization or subsequent doings. The effect of the evidence and the government argument is that Goodyear machines of the old type are capable of commercial use and could have been made by anyone who chose. That after the expiration of the two so-called basic patents machines constructed according to them were not used is sufficiently accounted for by the superiority of newer machines which the defendants introduced; the older machines did not enter into competition with them, and the defendants cannot be charged with suppressing such competition.

It is shown that improvements in machines and their manufacture were accomplished by constant investigation, experiment, testing, and invention by competent experts, involving a very large expenditure by the company. These efforts were directed not only toward making each machine as efficient as possible, but also toward increasing its efficiency for so operating upon a shoe as best to combine it with work upon the shoe by numerous other machines required for the remaining necessary operations in order that the many successive operations should co-operate toward the best final product. Besides thus developing and improving the 1899 machines the company invented and produced many other machines or improvements as the need became apparent.

This development of business resulted in a very great commercial success. Nor is there any question that, of all machines of the kinds to which this case relates in use when the petition was filed, those of the company constituted all but a very small proportion. Nevertheless, considering the whole field of machinery for stitching together bottoms and uppers of shoes, there has been free competition all the time. In that field of trade in shoe machinery to which the case is limited, the defendants have been not monopolists but competitors. Their only means have been legitimate—better machines. Their specialization, not monopoly, has been the cause of success.

The business which the defendants have developed and established is not and never has been one in which everybody might freely engage. No one else could lawfully make or use machines containing improvements covered by the defendant's patents. Nor did the demand for machines which they have supplied exist independently of the defendants, they created it by new methods which their improvements educated and enabled manufacturers to follow. It cannot justly be said that a field of commerce normally belonging to all has been captured by a single concern. In so far as the defendant's occupation of the field has been due to greater desirability of the patented machines and superiority of their methods of making and supplying users therewith, no reason appears for holding it unlawful, whatever its extent.

Methods introduced by the company for keeping machines in efficient operation have most effectively aided its business. It has undertaken not only to train operatives in proper use of machines and to secure prompt repair of any machine disabled in service, but also to supply each user with the latest improvements, either by adding them to machines or substituting improved for superseded machines, without extra cost. Standardization has effected a great reduction in the time of repair. While each of the component companies rendered some service of the character described, this was limited and the maintenance of any such system as the company pursued would have been impossible on account of cost.

The instances in which the company was producing or trying to develop for production a patented machine for doing work more or less similar to that for which the invention of the machine acquired was intended are the only instances capable of being regarded as of any possible significance for the purposes of the government case. In such cases the acquisitions were of patented improvements, whether or not embodied in an actual machine, enabling the company to increase efficiency of its own machines, or to complete development of others with which it was experimenting or which it had not yet made commercially successful. No case is found of such consequence as justifies the conclusion that the patent acquisition was to suppress competition or materially restrain trade. In most cases the machine or device acquired was claimed to infringe patents of the company, and the object of the acquisition was avoidance or compromise of pending or threatened litigation. It is still less possible to say that any wrongful absorption of a competitor's business has been proved. The acquisitions of this class are, in importance and amount, of relatively small consequence. It can hardly be said that any afforded anything more than a basis on which to build. During the eleven years in which these acquisitions gradually occurred the cases wherein the business of a concern producing shoe machinery was offered and refused were far more numerous than the cases of acquisition. The company's argument on the patent issues was by Mr. Frederick P. Fish, of Boston.

Full Scope of the Decision

Judges Putnam, Brown and Dodge of the United State District Court unanimously dismissed the dissolution suit of the United States against the United Shoe Machinery Company at Boston, Mass., last week. The validity of the patent rights is supported, the elimination of competition allegation is dismissed, the leasing idea is sustained and commended, and the company in general is complimented for its business dealings with shoe manufacturers. The suit was brought in 1911 by the United States under former Attorney-General Wickersham, alleging monopoly in violation of the Sherman act.

The opinion was written by each of the three judges, all concurring at the close in the dismissal of the bill. Judge Brown said in conclusion: "The shoe manufacturer has no just cause of complaint that the defendants offer restrictive leases. We conclude that, although the prohibitive leases, in so far as they tend to group together machines of different departments, may be re-

garded as a direct outgrowth of the consolidation, the consolidation was not for this reason in any way detrimental to the shoe manufacturer, but on the contrary was for his benefit, since it enabled the United company to offer him better terms and enabled him to equip his factory cheaper than before. The argument of the United States upon the tying of department to department shows no reason for invoking the Sherman act in behalf of the shoe manufacturer."

Judge Putnam said in part: "We fail to find in the development of the company and its operations any support for the alleged charges in the bill of intended oppression, arbitrary conduct, or anything of that nature, especially so far as regards allegations covering any demands to destroy or cripple competitors. We find no evidence of what was shown, especially in the Tobacco company cases, namely, a purpose to destroy what could not be acquired by straightforward methods. The fact that the company has acquired so large a percentage of the business of the country to which it devoted its energies is due so largely to the use of extraordinarily competent methods as to shut out from the eyes of the impartial investigator suggestions of other methods."

Judge Brown concluded that no unfair or unlawful competition was practised by the company in regard to patents. It is probable that the case will be carried to the United States Supreme Court.

Outputs of Large Generating Systems

The accompanying table, which includes data appearing in the ELECTRICAL WORLD of Jan. 23, gives statistics for 1914 on the outputs, peak load and load-factor of the largest generating systems of the country. The combined output of the thirty-six companies listed, one being estimated, is approximately 12,000,000,000 kw-hr. Three of the companies in the list—the Ontario Power Company, the Toronto Power Company and the Shawinigan Water & Power Company—are in Canada, although a large part of the output of the first two companies is exported across the border into the United States.

Of the 12,000,000,000 kw-hr. accounted for, approximately two-thirds was generated from water-power. In the last report issued by the Bureau of the Census, that of 1912, the total output of the 5221 central stations of the country was 11,532,963,006 kw-hr. The total horse-power of steam engines and steam turbines was given as 4,946,532, and the total horse-power of water-wheels as 2,471,081. It would appear, therefore, that over half of the electrical energy generated by the central stations of the country is obtained from water-wheel-driven units.

Two items of particular note in the tabulation are the yearly output of the Commonwealth Edison Company of Chicago and the yearly load-factor of the Hydraulic Power Company of Niagara Falls, N. Y. Very many of the companies sell large blocks of energy to electric railway companies, while others, notably those at Niagara Falls, Shawinigan Falls, Duluth and on the Ocoee River in Tennessee, find a large market for electrical energy in electrochemical industries. Fully one-half of the output of the Shawinigan Water & Power Company is used in the city of Montreal. The Mississippi River Power Company does a wholesale business only, selling energy largely to other utilities. About two-thirds of the total output of this company is taken by the public service companies in the city of St. Louis. Approximately 18 per cent of the output of the Detroit Edison Company went for the operation of streets and steam railways, 4 per cent to chemical work, 1 per cent to municipal lighting and other municipal services, 21 per cent for residence lighting, 25 per cent to general commercial lighting, and 31 per cent to industrial enterprises. The figures given for the Detroit Edison Company apply to the Detroit power houses only and do not include any part of the Eastern Michigan Edison power houses which feed into the same system.

Less than one-third of the output of the Puget Sound Traction, Light & Power Company of Seattle is used for railway purposes, the rest being sold for general electric service in the Puget Sound district. Out of the total of 292,500,000 kw-hr. reported by the Pacific Power & Light Corporation of Los Angeles, approximately 21,000,000 kw-hr. was generated by steam-engine-driven units. Approximately two-thirds of the output was used for railway purposes and the remainder for lamps and motor circuits. The Southern California Edison Company distributed its energy approximately as follows: Commercial and domestic lighting, 18 per cent; street lighting, 2 per cent; commercial power business, 52 per cent; railway load, 25 per cent; municipal light and other miscellaneous load, 3 per cent. The percentage of consumption for commercial and domestic lighting also includes that of approximately 140,000 lamp socket appliances rated at 500 watts. The commercial power represents energy sold for irrigation pumping, manufacturing, etc.

The outputs of the Montana Power Company and of the Utah Power & Light Company represent approximately all of the electricity used for any purpose whatsoever in both States. Of the energy generated by the Washington Water Power Company of Spokane, approximately one-third was used in mining operations, not quite one-half of the output was used for general service in the city of Spokane and in the country towns, while the remainder was used for railway purposes.

The ordinary maximum load on the Georgia Railway & Power Company's system occurred on Dec. 22 and

DATA ON LARGE GENERATING SYSTEMS

System	Peak Load in Kw	Date of Peak Load	Yearly Output in Kw-hr.	Yearly Load-Factor, per Cent
Commonwealth Edison Company	306,200	Dec. 15	1,114,130,000	43.6
Niagara Falls Power Company	131,520	Jan. 5	906,513,620	78.7
Ontario Power Company	130,500	Sept. 23	781,664,400	68.4
New York Edison and United Companies	229,787	Dec. 23	719,193,535	35.7
Hydraulic Power Company	87,457	Mar. 27	703,105,872	91.7
Pacific Gas & Electric Company	124,000	Oct. 29	658,298,000	60.6
Public Service Electric Company	123,539	Dec. 23	430,818,532	39.8
Shawinigan Water & Power Company	85,000	July 7	430,000,000	58
Montana Power Company	61,000	July 21	402,663,369	75
Mississippi River Power Company	73,700	Nov. 16	356,578,000	55.6
Duquesne Light Company	72,000	Dec. 21	315,210,796	50
Great Western Power Company	56,300	Dec. 9	315,000,000	64
Detroit Edison Company	83,300	Dec. 15	313,718,600	43
Puget Sound Traction, Light & Power Company	67,200	Dec. 17	299,622,508	50.9
Pacific Light & Power Corporation	70,565	Sept. 17	292,545,094	47.37
Southern California Edison Company	53,835	Dec. 24	288,549,552	61.1
Utah Power & Light Company	47,048	July 9	287,792,765	70
Pennsylvania Water & Power Company	74,000	Dec. 17	277,200,000	42.5
Philadelphia Electric Company	77,728	Dec. 1	250,697,952	36.8
Toronto Power Company	72,000	Dec. 4	236,328,680	37.5
Tennessee Power Company	47,600	Dec. 11	228,504,650	54.8
Electric Company of Missouri	52,528	Nov. 18	228,209,988	49.78
Boston Edison Company	65,342	Dec. 21	194,137,400	34
Union Electric Light & Power Company	51,072	Dec. 7	189,677,593	42.4
Portland (Ore.) Railway, Light & Power Company	44,315	Jan. 2	184,766,149	47.7
Washington Water Power Company	29,641	Dec. 29	169,691,800	65.4
Wisconsin Edison Company	44,124	Dec. 22	159,665,804	36.2
Brooklyn Edison Company	49,300	Dec. 9	153,946,900	35.6
Georgia Railway & Power Company	44,320	Oct. 28	145,684,800	37.5
Sierra & San Francisco Power Company	40,080	Jan. 6	179,444,960	51.2
Great Northern Power Company	30,400	Nov. 13	136,733,810	52
Rochester Railway & Light Company	28,500	Dec. 16	123,850,785	49.6
New England Power Company	35,000	Dec. 15	120,000,000	39
Minneapolis General Electric Company	27,955	Dec. 7	110,346,460	45.06
†Alabama Power Company	23,500	Dec. 22	55,837,740	27.1
*Southern Power Company	.....	.....	.....	.....

†Main station began operations April 14.
*No data received.

was 38,400 kw. The maximum given of 44,320 kw, which occurred on Oct. 28, was due to a temporary load of only a few weeks' duration of 10,000 kw, and the estimated kilowatt-hours for this temporary load approximated 4,000,000. If this special load be ignored, the regular load-factor of the system would be approximately 42 per cent instead of 37.5 per cent. Approximately 90,000,000 kw-hr. of the energy generated is used in the city of Atlanta.

One-half of the output of the Great Northern Power Company was used in the manufacture of calcium carbide, while the remainder was used for general electric services. The Rochester (N. Y.) Railway & Light Company showed a loss in output of 1 per cent over last year, while the maximum peak was 10 per cent less than that of last year. Seventy-six and one-half million kilowatt-hours was employed in lamps and motor circuits and 47,000,000 kw-hr. was used by the railway company. The lesser output this year as compared with last year was due in great measure to the lesser demand for energy by the street-railway system.

The Alabama Power Company of Birmingham, Ala., started its large hydroelectric station at Lock 12 in the Coosa River on April 14, so that the returns do not represent the capabilities of the company. Approximately, 50 per cent of the company's present output is sold to other utilities, and the remainder is used by manufacturers in various parts of Alabama.

The thirty-three American systems are fairly well scattered throughout the country, ten of them being west of the Rocky Mountains. The systems are arranged in the order of their output, and every effort has been made to include every company having a yearly output exceeding 100,000,000 kw-hr.

Progress of Federal Trade Commission Work

The members of the Federal Trade Commission have elected Mr. Edward N. Hurley vice-chairman. The commission spent most of the last week in getting settled in its offices in the old quarters of the Bureau of Corporations in the Department of Commerce and in warding off a horde of office seekers, mostly attorneys desiring appointment as assistant counsel or examiners. The appointment was announced of Mr. Raymond B. Stevens, former Representative from New Hampshire, as special counsel at $3,600 a year. Mr. Stevens helped to write the unfair practices clause of the trade commission act.

Outlines of policies to be pursued by the commission have become known as the result of conferences between Chairman Davies and callers in search of information as to the procedure to be followed. Reports that there might be a conflict between the Department of Justice and the commission, or an overlapping of duties and powers, were denied by Mr. Davies in conversation with a representative of the ELECTRICAL WORLD. One report, to the effect that the Department of Justice in future will charge itself with the handling of big cases in connection with anti-trust matters and that the commission will concern itself only with smaller cases, is declared to be erroneous. The commission is required by law to aid the Department of Justice in disentangling affairs of corporations where violation of the act has been disclosed by investigation. It may act either upon its own responsibility or request of the department. Chairman Davies regrets that there should have been any report of a possibility of differences. No such difference are likely to arise, he believes.

Business men who have counted upon the possibility of being able to obtain rulings in advance, or advisory information, with respect to specific plans they have in mind for their business will be disappointed. The question came up in connection with a mass of inquiries directed to the Department of Justice, in which corporations, firms and individuals all over the country sought to obtain specific information as to what they might or might not do under the trade commission act. These inquiries have been referred to the commission.

Members of the commission decided as a matter of policy that they will not give rulings in advance. While inquiries might be made in the best of faith, the details of circumstances might not always be complete. Members of the commission point out that business men heretofore have sought information from various government agencies as to what they might or might not do, and have proceeded in good faith on the answers received, only to find at times that nevertheless prosecutions for alleged violations of anti-trust laws have taken place.

For the commission to endeavor to give in advance rulings as to what business men might or might not do would subject it to a demand upon its time that might prove overwhelming. The commission cannot undertake to act as counsel or attorney for corporations, firms or individuals. Notwithstanding this, the commission will be glad to confer at all times with business men. President Wilson's idea, as expressed to the commissioners, is that they shall be of "constructive helpfulness" to business.

Chairman Davies has announced that almost the first work to be undertaken will be an inquiry into common selling agency plans such as are carried out abroad by foreign corporations, for the purpose of determining whether similar agencies may be organized here. This inquiry was ordered by the trade commission act. It is expected that the commission will shortly promulgate regulations to put the trade commission act into effect.

Federal Trade Committee of Chamber of Commerce

Directors of the Chamber of Commerce of the United States gathered in Washington on March 17 and 18 for their annual spring meeting and to plan the national activities of the body for the ensuing year.

One of the most important matters transacted was the selection of a committee, to be known as the federal trade committee, to co-operate with the new Federal Trade Commission. The committee is as follows: Messrs. Harry A. Wheeler of Chicago, chairman; Russ C. Butler, lawyer, Chicago; Alfred B. Koch, of Toledo, Ohio, president of the National Retail Dry Goods Association; W. L. Saunders, of New York, president of the Ingersoll-Rand Company; Guy E. Tripp, chairman of the board, Westinghouse Electric & Manufacturing Company; Morton A. Aldrich, dean of the college of commerce and business administration of Tulane University, New Orleans; Alexander W. Smith, lawyer, Atlanta, Ga.; Joseph P. Cotton, lawyer, New York and Boston; Henry R. Seager, economist, Columbia University, New York.

Maintenance of Re-Sale Prices Denied

Judge Hand of the United States District Court, New York, rendered a decision on March 23 dismissing an action brought by the Victor Talking Machine Company to restrain R. H. Macy & Company of New York from selling phonographs and records below stipulated prices. It was alleged that the defendants possessed nothing more than a non-assignable right of use. The court said that the only question was whether a patentee who had once received his royalty covering the use of the patented article during the entire life of the patent could prevent the transfer of the use of his license.

New York Rate Reduction Accepted

The New York Edison Company has announced that it will accept the order of the New York Public Service Commission, First District, reducing the maximum rate from 10 cents per kw-hr. to 8 cents per kw-hr. without lamp renewals. In its public announcement the company states that it will reduce the present statutory maximum rate of 10 cents to a maximum rate of 8 cents per kw-hr., without lamp renewals, for electrical energy for lighting and motor service. Such reduction, together with the reduction due to a general revision of the rate schedule, will involve a reduction in the cost of service to practically all consumers amounting to more than $1,750,000 per year.

"Consumers desiring to avail themselves of the lamp-renewal facilities of the company may continue to obtain that service at a charge of ½ cent per kw-hr. for present standard lamps, or they may obtain these lamps from the company at the lowest wholesale prices."

The order of the commission provides that on and after May 1, 1915, and for a period of three years thereafter, the maximum price to be charged by the company for electric service furnished by it in the city of New York, exclusive of the installation and renewals of electric lamps, shall be 8 cents per kw-hr., but this order shall not apply to that portion of the borough of the Bronx known as the old town of Kingsbridge, nor to that portion, if any, of the borough of the Bronx lying east of the Bronx River in which the company has the right or franchise to supply electric energy.

Commissioner Williams, who prepared the opinion, states that the New York Edison Company was formed about 1901 by the consolidation of a number of other companies and at that time carried on its books an entry of $78,000,000 for plant and property. No inventory or appraisal was made before this entry was placed on the books. By later additions, the company had increased this amount up to the end of 1913 to a total of $97,317,000. It also claims more than $10,000,000 for the value of assets of the New York Gas & Electric Company and property represented by bonds of the Edison Illuminating Company. It also claims an increase in real estate values, an increase in working capital, etc., sufficient to bring the total to something more than $132,000,000.

Commissioner Williams states that the Edison company, by efficient management, is earning a large return, he believes too large a return upon capital actually expended. Net earnings for the year 1913 amounted to $7,802,732, but these fell off about $650,000 for 1914. This leaves net earnings of about $7,150,000, if present rates are allowed to continue, which is equivalent to a return of 6 per cent on $120,000,000 or 5 per cent on $145,000,000. He therefore recommends a reduction in the maximum schedule charge to 8 cents per kw-hr., which would still leave the company $5,150,000 a year net based upon the 1914 business, or $5,800,000 net with business as good as in 1913. This would be 6 per cent on nearly $100,000,000, which he holds must certainly cover the "capital actually expended in the enterprise."

Commissioner Maltbie said: "The fundamental difference between Commissioner Williams and myself is that his plan will involve a cut in the net earnings of the company of only $1,800,000 or $1,900,000. I believe that the rates should be reduced to the extent of from $2,800,000 to $3,000,000. In other words, Commissioner Williams believes in allowing the company net profits of about $1,000,000 more than I do. If a total cut of $3,000,000 were made, the company would still have net earnings of $4,800,000, which is 7 per cent upon nearly $70,000,000, whereas the record does not warrant a finding of the value of the property in excess of $60,000,000. If one were to adopt the rate accepted by the United States Supreme Court in the Consolidated Gas case, viz., 6 per cent, the company would have a return upon $80,000,000, or $20,000,000 in excess of the fair value. It is unjust to the consumers to limit the reduction in the company's revenues to $1,800,000, for, according to the Court of Appeals, a public service corporation is entitled to a fair return and no more.

"If a reduction of the maximum rate to 8 cents is considered justifiable, there is still no ground for refusing to reduce the charge for energy to 7 or 6½ cents to the great mass of consumers and to install a meter charge of 50 cents, 75 cents or $1 per month. A flat rate of 8 cents up to 1000 kw-hr. per month will deprive a large number of consumers of any reduction commensurate with that given to the very small consumers. Yet consumers using from 25 to 2000 kw-hr. per month are the very ones who are now paying much more than they should."

Meeting of Concentric Wiring Committee

At the Biltmore Hotel, New York City, on Tuesday, was held the first meeting of the representative committee of business and technical experts elected on March 9 by the manufacturers of electrical supplies and materials entering into electrical construction, under the following resolution:

"Resolved, that a representative committee of business and technical experts be appointed to investigate the all-insulated system of building wiring as used at present in this country, and coincidently investigate grounded return systems together with concentric wiring:

"First—To determine the relative efficiencies of the two systems (a) as to safety to persons, (b) as to protection against fire, (c) as to the possible provision of methods of wiring at low cost, combined with ease of installation and sufficiently attractive appearance to obtain popular approval.

"Second—To present to the entire industry the results of its investigations in the form of concrete recommendations, including standard systems, standard devices and standard appliances."

After extended discussion of the work assigned to it, the committee decided that the first and basic question must be the determination of the relative efficiencies under headings (a) and (b) of the above resolution—first, present system of insulated circuits in buildings; second, grounded return circuits.

To give to the committee a sound basis for further procedure, the following were elected as a sub-committee to collect available data as to the advantages and disadvantages of grounded return systems for building construction: Messrs. C. E. Corrigan, National Metal Molding Company; W. H. Blood, Jr., National Electric Light Association; G. S. Lawler, Associated Factory Mutual Fire Insurance Company; J. R. Strong, Tucker Electrical Construction Company; F. W. Glading, Bureau of Standards, Washington; D. C. Jackson, Massachusetts Institute of Technology.

In view of the widespread effect of so radical a change in American wiring systems as would result from the complete adoption of grounded returns, the committee decided to begin its investigations at once by thoroughly sifting the theoretical advantages of that system, and in so far as possible obtaining authentic data of the results obtained in England and Continental Europe, where grounded returns have been used more or less.

Until the committee secures permanent headquarters, those interested in this subject are invited to address communications to the committee, care of Mr. LeRoy Clark, chairman, 114 Liberty Street, New York, N. Y.

Miscellaneous News Notes

Bill Regarding Competition in Ohio.—It is reported that the Senate committee on municipal affairs of the Ohio Legislature will reconsider its agreed recommendation of the Willis-Horn bill providing that municipalities, without condemning existing plants, may erect competing electrical plants in places where there are already privately owned plants in operation. If this is not done by the committee, the bill's defeat on the floor of the Senate is said to be almost certain.

Exposition Presents Bronze Tablet to Pacific Gas & Electric Company.—"Pacific Service" day was celebrated at the Panama-Pacific International Exposition on March 15 by 6000 employees of the Pacific Gas & Electric Company. Mr. John A. Britton, vice-president and general manager of the corporation, acted as chairman of the day as well as leader of the "family of 6000" in their rambles through the grounds. An address of welcome was made in the musical concourse by President C. C. Moore of the Exposition, who first called on the assemblage for three cheers for the Pacific Gas & Electric Company, and then presented to President F. G. Drum of that company a bronze plaque expressive of the Exposition's appreciation of the prompt and efficient service rendered. Mr. W. D'A. Ryan, chief of illumination, Mr. Guy L. Bayley, chief mechanical and electrical engineer, and Mr. H. D. H. Connick, director of works, spoke of the work accomplished and the part played by "Pacific Service."

Associations and Societies

Southwestern Electrical & Gas Association.—The eleventh annual convention of the Southwestern Electrical & Gas Association will be held May 19 to 22 at the Hotel Galvez, Galveston, Tex. Mr. H. S. Cooper, 405 Slaughter Building, Dallas, Tex., is secretary.

Dallas Electric Club Gives Buffet Dance.—On Saturday, March 13, the Dallas (Tex.) Electric Club, which has 219 members, gave a buffet dance to its friends at the Oriental Hotel, Dallas. An interesting part of the program was the distribution of electrical gifts to the ladies. Presents were provided for nearly all of the 150 women present, the gifts being drawn for by numbers on the programs. The club holds a luncheon every Friday.

Convention of Western Railway Telegraph Superintendents.—The Western division of the Association of Railway Telegraph Superintendents met at the Hotel LaSalle, Chicago, March 17 and 18, nearly 100 members and guests being present. Mr. L. M. Jones, superintendent of telegraph for the Atchison, Topeka & Santa Fé Railway, read a paper on the subject "Shall Inside Maintenance Work Be Handled by Linemen or Special Equipment Men?" Mr. W. Rogers, telegraph engineer for the Missouri-Pacific Railway, discussed "Modern Testing Facilities and Their Relation to the Railway Wire-Plant Efficiency," and Mr. E. H. Ward, of the Western Union Telegraph Company, New York, spoke on "Pole and Wire Maintenance." Mr. F. T. Wilbur, superintendent of telegraph for the Illinois Central Railroad, Chicago, is secretary of the Western Division of the association.

New York Electric Vehicle Association.—Mr. S. G. Thompson of the Public Service Electric Company, Newark, N. J., read a paper before the New York Section of the Electric Vehicle Association of America, March 24, entitled "The Development of the Electric Vehicle Market Through the Power Solicitor." Mr. Thompson spoke of what he considered the impassive attitude of the central station interests toward the electric vehicle, dwelling on the value of the electric-automobile-charging load to the central station. The speaker averred that the development of interest in the electric vehicle should be made part of the work of motor-service solicitors. Mr. Thompson outlined several plans for developing the electric-vehicle business of a community by the solicitor. In the discussion following Mr. Thompson's paper Messrs. F. W. Smith, W. P. Kennedy, C. A. Ward, A. B. Spaulding, H. H. Holding, A. J. Marshall, D. F. Tobias and Harvey Robinson took part.

Public Service Commission News

Idaho Commission

The commission has drafted a schedule of uniform rates as a result of complaints from small consumers of electrical energy for motor service.

Rules governing construction and equipment of poles and wires have been formally promulgated by the commission.

New York Commissions

Commissioners McCall, Williams, Cram and Wood of the First District commission appeared in person before Governor Whitman at Albany on March 23 to answer the charges made against them by the legislative investigating committee. All filed printed briefs. The proceedings were made dramatic by the statements of Commissioner Williams, who, under mental strain as the result of sickness, criticised the work of the investigators and the Governor in a bitter manner.

Chairman McCall, referring to the charge that he had been neglectful in not supervising the handling of complaints, said: "The same system of treating these matters is in vogue to-day that I found when I went into the commission. This method is the only practicable way to treat these matters. It is preposterous and absurd to contend that the commissioners personally should take up these questions from their inception and follow them out in detail to a solution."

Regarding the charge that he devoted time to his private law practice, Chairman McCall said: "The entire time given by me to private practice in the two years or more that I have been chairman of the commission would not amount to more than thirteen days." As for absenting himself from stated meetings, he said that during his whole service he had not once taken a regular vacation, and that on the occasions he was absent from meetings he had gone over the matters to be considered in advance and the functions of his office had been adequately performed.

Mr. McCall declared that he had not used a public automobile for private purposes with the same freedom that he had used his private automobile for public purposes. He also declared that he had purchased springs, shoes and tires for the commission automobile. The use of the automobile, he said, "is a cheap and tawdry charge to urge as a basis for removing the chairman of the Public Service Commission for the First District for malfeasance in office."

In conclusion, Chairman McCall says that it is more or less common "in connection with changes of administration for officials to be removed for partisan or other purposes, without there necessarily being involved any reflection on the ousted official." The removal of a commissioner for other than good cause "will establish a precedent which may well be availed of by the successors of the present incumbent of the governorship. With the fixity of tenure and the immunity from political attack destroyed there would remain only to attract to the office of commissioner the matter of salary, and this would not be compensation to any man worthy of the name for going through the muckraking of sensational newspaper attacks."

Commissioner Williams referred to the action of the Governor and his "cruel piratical politicians," but at the demand of Mr. Whitman he apologized. He said that the newspapers had quoted the Governor as saying that the purpose of the proceeding was merely to give the commissioners a decent burial. He continued to make statements criticising the investigation until the proceedings were postponed.

Commissioner Cram said in his reply: "I now come to the most disagreeable charge of all. The report says I am a fool. That is not an agreeable charge to answer. I am not. There is another disagreeable spot. The investigators call me an imbecile, and when a man is called that he must make a reply. I am not inefficient. As to my merits, I do not care to bring them to your attention."

Commissioner Wood denied the charges against him and gave copies of many letters which he had received in reference to his activities in endeavoring to obtain better transit facilities.

The hearing was postponed until April 6. Governor Whitman will go over the replies in detail.

Ohio Commission

Through an agreement between the commission and the efficiency department of the Civil Service Commission, five appraisal engineers in the light and power department of the commission will be dismissed and their positions abolished. Four similar positions in the railway department will meet a similar fate. Salaries of a number of other employees will be reduced, and still others will be dismissed. This action came as a result of the effort of the administration to reduce expenses. City officials of Cleveland charge that utility companies are responsible. They say that the changes have been made to cripple the commission so that the appraisement of certain properties, including the Cleveland Electric Illuminating Company, must be delayed indefinitely. Cleveland's rate-making ordinance cannot become operative unless an appraisal shows that it provides a reasonable return. The reduction of the force of appraisal engineers will probably cause delay. A bill before the Legislature removes the compulsory appraisal feature of the public utilities act. If it becomes law the commission may give its attention only to such properties as it decides should be investigated.

The light committee of the City Council of Cincinnati, Ohio, has reported a resolution authorizing City Solicitor Schoenle to bring proceedings before the commission for the purpose of ascertaining when that body will have its valuation of the Union Gas & Electric Company properties completed.

Wisconsin Commission

The commission has authorized the North American Company to put into effect at Burlington, Wis., the same general schedule of rates which has been adopted for practically all of the company's holdings in Wisconsin. It provides for a Hopkinson demand rate for both light and motor service and a limiting increment rate for lighting service. The schedule includes also a residence rate which bases the increment scale of charges upon the number of designated active rooms, an off-peak rate, an optional power rate, and a short-time rate for light and motor-service consumers. The monthly bills of certain motor-service users will be increased under the proposed schedule, but the increase will be no more than the increase considered necessary by the commission at the time the Burlington Electric Light & Power Company petitioned for an increase in rates before it was acquired by the present petitioner.

The Ladysmith Lighting Company has been ordered to discontinue its present flat rate of 10 cents per kw-hr. for commercial lighting and to substitute therefor the following schedule prescribed by the commission: Primary rate, 10 cents net per kw-hr. for all or part of the first forty hours' use per month of the active connected load; secondary rate, 8.5 cents net for the next sixty hours' use per month of the active connected load; excess rate, 6 cents net. In Class A, consisting of residences, 60 per cent of the connected load is to be considered active where the total connected load is less than 500 watts nominal rated capacity; where the installation exceeds 500 watts, one-third of the excess is to be considered active. In Class B, consisting of stores, offices, professional places, public halls, depots, theaters, etc., 70 per cent of the first 2.5 kw nominal rated capacity and 55 per cent of the excess is to be deemed active. In Class C, consisting of county and city buildings, schools, factories, industrial establishments, shops, stables, etc., 55 per cent of the total connected load is to be considered active. Incidental appliances, such as flatirons, toasters, fans, etc., to the amount of 1000 watts rating, are not to be considered in determining the active load.

The motor-service rate provides for a service charge of 50 cents net per active horse-power per month and an output charge of 4 cents net per kw-hr. The percentages of the rated motor capacities to be deemed active range from 90 per cent for the first 10 hp installed to 40 per cent for capacities over 60 hp.

In its decision the commission called attention to the fact that the service of the defendant has remained inadequate notwithstanding repeated warnings that the commission standards of service were not being complied with. Ninety days' time is to be given within which to complete any work of reconstruction, repair and testing necessary for efficiency of plant and adequacy of service.

Personal

Mr. H. S. Williams, local manager at Plymouth, Pa., of the Luzerne County Gas & Electric Company, has resigned. His successor is Mr. A. J. Llewellyn.

Mr. C. L. Proctor, for the past six years general superintendent and purchasing agent for the Athens (Ga.) Railway & Electric Company, has resigned to accept a position with the Empire District Electric Company at Joplin, Mo.

Mr. A. J. Llewellyn, who for the past ten years has been superintendent and chief electrician of the Luzerne County Gas & Electric Company, Plymouth, Pa., has been appointed local manager of the company, vice Mr. H. S. Williams, resigned.

Mr. E. A. Wilcox, who for the past six years has been connected with the Great Shoshone & Twin Falls Water Power Company at Twin Falls, Idaho, has resigned the position of commercial agent for that company to accept a position in the commercial department of the Great Western Power Company of San Francisco.

Prof. Clarence Floyd Hirshfeld, who until recently was a member of the engineering faculty at Cornell University, Ithaca, N. Y., has accepted a position in the research laboratory of the Edison Illuminating Company of Detroit, Mich., where he will devote a considerable portion of his time to studying problems of electric industrial heating.

Mr. D. C. Green, well known in Western electrical circles, has been appointed manager of the Salt Lake division of the Utah Power & Light Company. Mr. Green came from Everett, Wash., where he has had charge of gas and electric properties. He formerly held similar positions in San Diego and Monroe, Cal., and Marshfield and Albany, Ore.

Mr. Oscar Turner, president of the Turner Electric Company of Birmingham, Ala., was presented with a gold watch by the Electrical Supply Jobbers' Association during its recent Chicago convention, in token of Mr. Turner's untiring work and interest in making arrangements for the preceding Birmingham meeting. The presentation address was made by Mr. Gilbert Smith, of J. F. Buchanan & Company, Philadelphia, Pa.

Mr. R. A. MacGregor, who resigned as power-sales engineer for H. L. Doherty & Company of New York, April 1, to accept a position as sales manager of the Merchants' Heat & Light Company at Indianapolis, Ind., entered the electrical business in 1900. In 1905, working under the direction of Mr. E. T. Penrose, then general superintendent of the West Penn Company at Connellsville, Pa., he gained his first experience in motor-service sales work and subsequently was appointed by the C. H. Geist Company to devote all of his time to motor-service sales at Plymouth, Pa. Later he was transferred to Chicago, Ill., and received charge of all of the commercial work of the C. H. Geist Company. Resigning in the fall of 1908, however, he accepted a position with H. L. Doherty & Company, which was then operating the Easton (Pa.) Gas & Electric Company. One year later Mr. MacGregor left the Doherty company to take the management of the Light, Heat & Power Company at Connersville, Ind., and there in two years doubled the number of the company's customers and increased its net revenue 60 per cent. In the fall of 1911 Mr. MacGregor again accepted a position with H. L. Doherty & Company as sales manager of the Empire District Electric Company at Joplin, Mo., and while holding this position he and his sales force closed contracts for 22,000 hp of electric service in twenty months. Later Mr. MacGregor was transferred from Joplin to the New York office of the Doherty company, from which office he has been working for the last year.

R. A. MACGREGOR

Corporate and Financial

Increase Approved.—Stockholders of the Consolidated Gas, Electric Light & Power Company of Baltimore approved the increase in stock from $20,000,000 to $30,000,000. No offering is expected at the present time.

Mount Whitney Power & Electric to Issue Bonds.—The Mount Whitney Power & Electric Company, Visalia, Cal., has been authorized by the California Railroad Commission to issue $238,000 of its 6 per cent bonds at not less than 95.

Beloit Water, Gas & Electric to Issue Bonds.—The Beloit (Wis.) Water, Gas & Electric Company has been authorized by the Wisconsin Commission to issue $100,000 of 5 per cent bonds at not less than 92.5 to provide funds for extensions and improvements.

American Public Utilities Note Issue.—Bioren & Company, Philadelphia, Pa., are offering $1,500,000 of three-year 6 per cent secured gold notes of the American Public Utilities Company, Grand Rapids, Mich., due on March 1, 1918, at par and interest.

Santa Barbara Gas & Electric to Issue Bonds.—The Railroad Commission of California has authorized the Santa Barbara Gas & Electric Company to issue $100,000 of 6 per cent thirteen-year bonds to be used in retiring $78,000 promissory notes and for additions and betterments.

Wisconsin-Minnesota Light & Power to Issue Bonds.—The Wisconsin-Minnesota Light & Power Company has been authorized by the Wisconsin commission to issue $36,000 bonds at not less than 75. The funds are to reimburse the company for expenditures in acquiring new properties.

Southern Sierras Power Bond Issue Authorized.—The California Railroad Commission has provisionally authorized the Southern Sierras Power Company, Denver, Col., to issue $300,000 of 6 per cent twenty-five-year bonds under a mortgage and deed of trust to the International Trust Company of Denver.

Central Wisconsin Railways & Utilities to Issue Stock.—The Central Wisconsin Railways & Utilities Company has been authorized by the Wisconsin Railroad Commission to issue $10,000 stock for the purpose of buying a right-of-way and the material for the construction of a transmission line from the city of Berlin to the city of Red Granite.

Oro Electric Authorized to Pledge Bonds for Notes.—The Oro Electric Corporation of Oroville has been authorized by the California Railroad Commission to pledge $180,000 par value of its bonds as collateral security for an issue of $60,000 of notes, which are to be dated March 26, 1915, and to mature serially within a period of one year after date.

Electric Light & Power Company of Abington & Rockland Issues New Stock.—Stockholders of the Electric Light & Power Company of Abington and Rockland, North Abington, Mass., of record March 1, 1915, have been offered the right to subscribe pro rata to 945 additional shares of stock at 130. All stock not subscribed by March 27 will be sold at auction for the benefit of the company. The company is managed by the Stone & Webster Management Association.

Merchants' Heat & Light Earnings.—The earnings of the Merchants' Heat & Light Company of Indianapolis, Ind., a subsidiary of the American Public Utilities Company, Grand Rapids, Mich., for the year ended Dec. 31, 1914, were as follows:

Gross earnings	$790,177
Operating expenses and taxes	501,687
Net earnings	$288,490
Bond and other interest	151,835
Dividends	66,000
Balance	$70,655

Wisconsin-Minnesota Light & Power Earnings.—Earnings of the Wisconsin-Minnesota Light & Power Company, La Crosse, Wis., a subsidiary of the American Public Utilities Company, Grand Rapids, Mich., for the year ended Dec. 31, 1914, were as follows:

Gross earnings	$1,033,414
Operating expenses and taxes	521,760
Net earnings	$511,654
Bond and other interest	232,021
Dividends	55,213
Balance	$224,420

Westinghouse Machine Scrip Market.—The Westinghouse Electric & Manufacturing Company is offering to buy and sell scrip representing Westinghouse Machine stock deposited for exchange for Westinghouse Electric stock. The plan of exchange called for three shares of machine stock for each share of electric stock, and as a result certificates representing fractional shares of electric stock were left outstanding. The electric company will buy or sell these certificates on a basis of $12 a share for machine stock, the offering to cover only the certificates which entitle the holder to fractional shares of the electric company's stock.

Southern California Edison to Issue Securities.—The Southern California Edison Company of Los Angeles, Cal., has been authorized by the Railroad Commission to issue $2,500,000 of five-year 6 per cent debentures at not less than 95 and interest. The proceeds are to be used for the retirement of $332,000 outstanding issues of debentures, $1,596,890 for the payment of notes, $403,110 for reimbursement of capital accounts, and $168,000 for additions and betterments. The company was also authorized to issue 27,500 shares of common stock for refunding $2,500,000 debentures on the basis of eleven shares of stock for one debenture of $1,000 face value. The stock is to be made available for such debenture holders as may elect to take it in substitution for their securities.

Columbus Railway, Power & Light Annual Report.—In his annual report for the year ended Dec. 31, 1915, President Samuel G. McMeen of the Columbus (Ohio) Railway, Power & Light Company stated that there has been a continued growth in the use of electric energy for domestic purposes along two principal channels. One is in homes not formerly supplied, under advantageous opportunities for the wiring of premises on easy terms; the other is in the use of electric energy for domestic purposes through the installation of lamps of increased illumination and of household devices. The statement for 1914 follows:

Gross receipts	$3,066,298
Operating expenses	1,657,619
Net receipts	$1,408,679
Interest, taxes, rentals and depreciation	783,101
Balance	$625,578
Surplus	448,185
Dividends	$177,393

New England Power Annual Report.—The net earnings of the New England Power Company for 1914, according to its annual report, were reduced on account of the extraordinary dry season and the anticipation of the development of plant No. 5. The demand for energy continued without interruption throughout the year, and the management considered it wise to secure as many contracts as possible in order that the new plant might have a large and paying load as soon as it was placed in operation. This policy resulted in an increase in the amount of auxiliary steam-power used on the system and the direct charge to construction of $88,000 on account of the steam-power purchased which otherwise would have been furnished through plant No. 5 had that station been completed. The output has grown from 34,000,000 kw-hr. in 1910 to 120,000,000 kw-hr. in 1914, while gross earnings increased from $270,000 to $982,000 in the same period. The statement for the year ended Dec. 31, 1914, follows:

Gross earnings	$982,528
Operating expenses and taxes	472,788
Net earnings	$509,740
Bond interest	332,497
Balance	$177,243
Note interest	21,115
Balance current year	$156,128
Surplus beginning current year	164,145
Total	$320,273
Dividends	246,600
Net surplus	$73,673

American Power & Light Annual Report.—The American Power & Light Company of New York, which controls the Kansas Gas & Electric Company, the Pacific Power & Light Company, the Portland Gas & Coke Company and the Southwestern Utilities Corporation, has published its annual report for the year ended Dec. 31, 1914. The combined

companies have 68,030 electric customers, generating equipment of 61,978-kw rating, and had an output during the year of 138,838,509 kw-hr. The rating of generating equipment now under construction is 12,115 kw. Of the consolidated gross earnings for the year 1914 approximately 58 per cent was derived from electric light and motor-service business, and the remainder from gas, railway and water. The company's earnings statement follows:

Gross earnings		$1,461,580
Expenses		387,526
Net earnings		$1,074,054
Interest and discounts		534,552
Net income		$539,502
Combined net surplus of controlled companies, after payment of dividends	$234,621	
Transferred to reserve for depreciation	185,908	
Balance undistributed surplus	$48,713	
Less amount accruing to common stock not owned by company	4,553	
Balance accruing to company		44,160
Total net income, 1914		$583,662
Less preferred stock dividends paid		187,188
Balance		$396,474
Less common stock dividends paid		302,476
Balance combined surplus year ended Dec. 31, 1914		$93,998
Surplus American Power & Light Company, Dec. 31, 1913		276,698
Surplus Dec. 31, 1913, of controlled companies	$964,899	
Less amount accruing to common stock not owned by company	10,433	
Balance surplus		$954,466
Balance combined surplus Dec. 31, 1914		$1,325,162

Pacific Gas & Electric Report.—A preliminary report for the Pacific Gas & Electric Company for the year ended Dec. 31, 1914, shows that gross income increased from $11,342,140 in 1907 to $17,220,504 in 1914. During the year the company made a net addition of 29,321 customers, making the total number of customers served 378,705. During the seven years the average yearly gain in customers has been 28,000. It is estimated that additional customers on the books at the beginning of the current year will produce at least $1,000,000 increase in gross revenue. A substantial addition to the revenue is also assured from the exclusive contract which the company has for supplying the Panama-Pacific International Exposition with gas and electrical energy for heating, motor service and illuminating service. During 1914 the company expended $2,734,000 for new construction. The balance sheet of Dec. 31, 1914, when published, will show current assets of $8,190,659 and current liabilities of $5,056,083. Since Jan. 1, 1915, the company has paid all of its floating debt, amounting to about $1,400,000, and also called for redemption on March 25, 1915, $1,000,000 of its outstanding one-year gold notes, leaving but $3,000,000 of the latter outstanding as compared with the maximum amount of $7,000,000 outstanding a year ago. It is anticipated that the remainder of these notes will be redeemed by July 1, 1915, which will result in entirely relieving the income account of the heavy charge for note interest and discount. The statement of earnings follows:

	1914	1913
Gross operating revenue	$16,912,688	$15,896,006
Deduct maintenance operating expenses, taxes, etc.	8,913,922	9,331,207
Net earnings from operating	$7,998,766	$6,537,799
Add profit on merchandise sales, etc.	307,816	333,331
Total net income	$8,306,582	$6,871,130
Bond interest	3,890,341	3,783,197
Balance	$4,416,241	$3,087,933
Interest on one year notes and floating debt (temporary)	301,060	118,847
Balance	$4,115,181	$2,969,086
Bond discount and expense	147,715	147,491
Balance	$3,967,466	$2,821,595
Discount and expense on one year notes (temporary)	321,800	98,531
Balance	$3,645,666	$2,723,044
Deduct dividends:		
First preferred stock	14,984	.....
Second preferred stock	600,000	600,000
Common stock	.....	398,848
Balance	$3,030,682	$1,724,196
Less reserves:		
For revenue involved in pending rate litigation	554,362	261,734
For depreciation	1,000,000	1,462,462
Balance to corporate surplus	$1,476,320	.....

Manufacturing and Industrial

Harry M. Hope, consulting engineer, formerly with the Stone & Webster Engineering Corporation, has opened offices at 141 Milk Street, Boston, Mass.

The Burke Electric Company, Erie, Pa., has appointed Mr. George Hills as head of its arc-welding department. Mr. Hills will be stationed at the main office and works in Erie, Pa.

Motor Manufacturer Busy.—The Robbins & Myers Company, Springfield, Ohio, reports that its business has increased so rapidly since the first of the year that it has been necessary to put some of its departments on overtime.

Theobald M. Quinn, engineering contractor, 343 Cutler Building, Rochester, N. Y., has taken over that part of the business of the firm known as Morrison & Quinn, Inc., which pertained to the manufacture and sale of concrete lighting standards.

The Wilson-Maeulen Company, Inc., 1 East Forty-second Street, New York, is a company that has been recently formed and which is manufacturing electric pyrometers and recorders. Mr. Charles H. Wilson is president and treasurer of the company; Mr. C. J. Brown is secretary.

Williams & Bradbury.—Mr. Lynn A. Williams and Mr. Clifford C. Bradbury announce the formation of a partnership for the practice of patent, trade-mark and copyright law, under the firm name of Williams & Bradbury, with offices at 719-722 Monadnock Block, Chicago, Ill.

The Noveau Lamp Company, Lincoln, Cal., is the name of a company recently formed which is engaged in the manufacture of ornamental electroliers, lanterns, brackets and pedestals. Mr. R. B. Keeler is president, Mr. P. O. Tognelli first vice-president, Mr. M. F. Johansen second vice-president, and Mr. C. W. Urich secretary.

The Mignon Wireless Corporation, Elmira, N. Y., has recently been formed and will manufacture, develop, sell and buy wireless-telephone and wireless-telegraph apparatus. The officers of the company are Mr. E. C. Mignon, president, formerly with the New York Telephone Company; Mr. J. G. Gerhart, vice-president, formerly with the American Thermostat Company, and Mr. C. A. Meith, secretary and treasurer, formerly with the Elmira Water, Light & Railroad Company.

Electric Gear Shift for Gasoline Automobiles.—The "Vulcan" electric gear shift, described in the ELECTRICAL WORLD of Feb. 27 and made by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., will be furnished by the Winton, Jeffery and Pullman car manufacturers when specified. Several other prominent manufacturers are preparing to supply this device with their cars in the future. With the electric gear shift the lever is eliminated and the gears can be changed by means of push-buttons on the steering wheel.

Business of Carbon-Brush Manufacturer Increasing.—According to Mr. H. S. Greene, assistant general sales manager of the Nungesser Carbon & Battery Company, Cleveland, Ohio, thus far this year the business of the company is larger than that of any other similar period in the history of the company. The company is selling its products to street railways, steam railways, steel mills, manufacturers of electric cranes of every description, electric-signal manufacturers, central stations, automobile starter and lighter manufacturers, dynamo and motor manufacturers, circuit-breaker manufacturers, railway-car-lighting manufacturers, electric-drill manufacturers, etc.

Electrical Apparatus for Sugar Manufacturer.—The Manati Sugar Company, in the Province of Oriente, Cuba, with offices in New York, has recently placed an order with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for motors to drive all of its machinery in its new mill with the exception of the engine-driven rolls. This order includes thirty-two alternating-current motors, having a total rating of 1042 hp. All of the auxiliaries in this extension of the Manati Sugar Company will be motor-driven, and they will include cane and bagasse conveyors, centrifugal pumps, crystallizers, agitators, etc. All of the new material will be ready for operation for the 1915-1916 grinding season, and the equipment will be delivered, it is asserted, in time for this work.

The Aladdin Lamp Corporation, 111 Broadway, New York, has appointed Mr. G. P. Callary general sales manager for northern Pennsylvania, with headquarters at Scranton, Pa. Mr. Callary has been employed by the company for the past three months as field manager, during which time he appointed a number of district managers in Pennsylvania, Ohio and Michigan. Mr. L. W. Phelps, general sales manager in western Pittsburgh for the Aladdin Lamp Corporation, has turned over the sales agency to Mr. C. C. Whithaus, 241 Oliver Building, Pittsburgh, and will go to Chicago to organize the general sales agency there, having charge of the northern Illinois territory. The Aladdin Lamp Corporation is manufacturing the "Vanitie" portable electric lamp. This lamp is being exhibited at the San Diego Exposition by the Southern Electric Company of San Diego, Cal.

Wegmann & Hillberg, hydraulic engineers, South Ferry Building, New York, is the name of a new concern which will be engaged in consulting-engineering work on water-power developments, sewer systems and irrigation, water-works and drainage projects. Mr. Edward Wegmann was for more than thirty years connected with the construction of the Croton water-works for the city of New York. He was the last chief engineer of the Aqueduct Commissioners and subsequently for four years was consulting engineer of the Department of Water Supply, Gas and Electricity. He is well known through his books, "Design and Construction of Dams" and "The Water Supply of the City of New York." Mr. A. G. Hillberg has been connected with large hydro-electric developments, notably the Mississippi River Power Company's plant at Keokuk, Ia. For the past two years he has been associate editor of the *Engineering Record*, in charge of hydraulics.

Government Orders Large Amount of Submarine Cable.—What is said to be one of the largest orders for submarine cable recently awarded by the government has just been placed with the Atlantic Insulated Wire & Cable Company, New York. This order, which is from the torpedo department, calls for 70 miles of nineteen-conductor, steel-armored cable, which is to be used for mining harbors. It is to be made up in lengths of one mile each and is to be shipped with one length to a reel. Each reel will weigh 16,000 lb. On an order of this nature the output of the company's plant will be about 12 miles per week. During recent years the Atlantic Insulated Wire & Cable Company has shipped 320 miles of cable to Manila and 180 miles to Alaska for governmental use. The cable across the race at the entrance to Long Island Sound was made by the above company and consists of one length of 35,000 ft. It is said to be the largest cable that the government has on the Atlantic Coast.

Walker & Cressler, consulting engineers, 742 First National Bank Building, Chicago, Ill., is the name of a firm recently formed by Mr. James Walker and Mr. George H. Cressler. Both men are graduates of the Sheffield Scientific School of Yale University, Mr. Walker as a civil engineer in the class of 1894 and Mr. Cressler as a mechanical engineer in the class of 1902. Mr. Walker has been engaged in consulting practice in Chicago for ten years, being identified during that period with work in connection with the Chicago Elevated Railways Company, the Chicago Surface Lines, the Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals, various electric-railway, lighting and power companies, and financial institutions interested in public utility properties. Mr. Cressler has for the past ten years been vice-president and chief engineer of the Kerr-Murray Manufacturing Company, Fort Wayne, Ind. He has designed and constructed gas-works installations in more than 100 cities of the United States and Canada. The firm is engaged in work on railway, gas and electric utilities.

Fan Installations for Heating and Ventilating.—The Bethlehem Steel Company has recently placed in service three sets of fans manufactured by the Buffalo Forge Company, Buffalo, N. Y., for use in the heating and ventilating of its new buildings, the shrapnel shop, the fuse building and the powder-loading building. The shrapnel shop is 78 ft. wide, 280 ft. long and 30 ft. high and is equipped with a No. 10 "Niagara conoidal" fan, with a rating of 40,000 cu. ft. of air per minute, and five four-row sections of return-bend heater with 6500 ft. of pipe. The fuse building is 200 ft. long, 60 ft. wide, and has two wings 120 ft. long and 60 ft. wide, all being 20 ft. high. It is equipped with a No. 11 "Niagara conodial" fan, with a rating of 39,000 cu. ft. of air per minute, and six sections of heater containing 8000 ft. of pipe. The apparatus in the powder-loading building, which is 120 ft. long, 40 ft. wide and 18 ft. long, consists of a No. 5 "Niagara conoidal" fan, delivering 9000 cu. ft. of air per minute, and five sections of heater. The galvanized air ducts were made and installed by Hersh & Brother, Allentown, Pa. The fan system of heating is used throughout in the plant of the Bethlehem Steel Company. One of the recent installations is a carrier air washer for the new physical laboratory building of the company which purifies all the air delivered into the building and automatically maintains the humidity control.

Manufacturers' Exhibits at the Panama-Pacific Exposition.—The various manufacturers' exhibits of electrical interest at the Panama-Pacific International Exposition, San Francisco, are distributed among four buildings, the Palace of Machinery, Palace of Manufactures and Varied Industries, Palace of Mines and Metallurgy, and Palace of Transportation. A number of manufacturers have displays in more than one building. Following is an alphabetical list of the manufacturers having exhibits of interest to the electrical industry:

Acme Machinery Company, Cleveland, Ohio, bolt and rivet-making machinery, Palace of Machinery.

Advance Pump & Compressor Company, Battle Creek, Mich., power pumps and air compressors, Palace of Machinery.

Aldrich Pump Company, Allentown, Pa., pipe, Palace of Machinery.

Almond Manufacturing Company, T. R., Ashburnham, Mass., drill chucks, Palace of Machinery.

American Blower Company, Detroit, Mich., mine fan, Palace Mines and Metallurgy.

American Bridge Company, Pittsburgh, Pa., steel tower and poles, Palace of Machinery.

American Cast Iron Company, Birmingham, Ala., pipe, Palace of Machinery.

American Clutch Company, Amesbury, Mass., friction clutches, pulleys and accessories, Palace of Machinery.

American Pulley Company, Philadelphia, Pa., wrought steel belt pulleys and accessories, steel reels and spools, Palace of Machinery.

American Steam Pump Company, Battle Creek, Mich., pumps and air compressors, Palace of Machinery.

American Sheet & Tin Plate Company, Pittsburgh, Pa., sheet metals for electrical use, Palace of Machinery.

American Steel & Wire Company, Chicago, Ill., wire and cables, Palace of Machinery.

American Tool Works Company, Cincinnati, Ohio, lathes, Palace of Machinery.

American Well Works, Aurora, Ill., pumps, Palace of Machinery and Palace of Mines and Metallurgy.

American Taximeter Company, New York, N. Y., automobile accessories, Palace of Transportation.

Ams Machine Company, Max, Mt. Vernon, N. Y., sheet-metal machinery, Palace of Machinery.

Andrew & Company, Jno. Hy., Ltd., Sheffield, Eng., drill steel, tool steel, wiredrawing dies, Palace of Machinery.

Apple Electric Company, Newark, N. J., automobile accessories, Palace of Transportation.

Armstrong Brothers Tool Company, Chicago, Ill., lathes and planer tools, Palace of Machinery.

Armstrong, L. D., San Francisco, Cal., pumps and air compressors, Palace of Machinery.

Ashton Valve Company, Boston, Mass., valves and steam gages, Palace of Machinery.

Atkins & Company, E. C., Indianapolis, Ind., saws for cutting metal, Palace of Machinery.

Aurora Tool Works, Aurora, Ind., drill presses, Palace of Machinery.

Babcock & Wilcox Company, New York, N. Y., boilers, Palace of Machinery.

Badenhausen Company, Philadelphia, Pa., boilers, Palace of Machinery.

Bailey & Blendinger, Woburn, Mass., machine knives, Palace of Machinery.

Baldwin Locomotive Works, Philadelphia, Pa., electric mine locomotive, Palace Mines and Metallurgy.

Baker-Hansen Manufacturing Company, East Oakland, Cal., air compressors, Palace of Machinery.

Baruch Electric Controller Corporation, San Francisco, Cal., circuit breakers, Palace of Machinery.

Berger & Carter Company, San Francisco, Cal., sheet-metal shaping process and motors, Palace of Machinery.

Bessemer Gas Engine Company, Grove City, Pa., gas and oil engines, Palace of Machinery.

Bliss, E. W. & Company, Brooklyn, N. Y., sheet-metal machinery and steel pinions, Palace of Manufactures and Varied Industries and Palace of Machinery.

Bond Company, Chas., Philadelphia, Pa., leather belting, Palace of Machinery.

Bond Foundry & Machine Company, Manheim, Lancaster Co., Pa., power-transmitting machinery, Palace of Machinery.

Bowie Switch Company, San Francisco, Cal., switches, Palace of Machinery.

Bristol Company, Waterbury, Conn., recording instruments and pyrometers, Palace of Mines and Metallurgy, Palace of Machinery and Palace of Manufactures and Varied Industries.

Brown Portable Elevator Company, Chicago, Ill., conveying and elevating machinery, Palace of Machinery.

Buffalo Gasolene Motor Company, San Francisco, internal combustion engines, Palace of Machinery.

Busch-Sulzer Brothers Diesel Engine Company, St. Louis, Mo., internal combustion engines, Palace of Machinery.

Builders' Iron Foundry, Providence, R. I., grinding and polishing machinery, Palace of Machinery.

Byron Jackson Iron Works, San Francisco, Cal., pump, Palace of Mines and Metallurgy.

Canadian Bond Hanger & Coupling Company, Ltd., Alexandria, Ont., Power Transmitting Machinery, Palace of Machinery.

Carborundum Company, Niagara Falls, N. Y., grinding materials, Palace of Machinery.

Central Telephone & Electric Company, St. Louis, Mo., hand lanterns, Palace of Machinery.

Century Electric Company, St. Louis, Mo., motors, Palace of Machinery.

Chain Belt Company, Milwaukee, Wis., chain belting and elevator buckets, Palace of Machinery.

Chisholm & Moore Manufacturing Company, Cleveland, Ohio, chain hoists, trolleys, cranes, Palace of Machinery.

Cincinnati Electrical Tool Company, Cincinnati, Ohio, electric tools, Palace of Machinery.

Cincinnati Iron & Steel Company, Cincinnati, Ohio, lathes, Palace of Machinery.

Clyde Iron Works, Duluth, Minn., hoisting machinery, Palace of Machinery.

Concordia Safety Lamp Company, Pittsburgh, Pa., electric safety mine lamp, Palace of Mines and Metallurgy.

Cook Railway Signal Company, Denver, Col., automobile accessories, Palace of Transportation.

Cowan Truck Company, Holyoke, Mass., trucks, Palace of Machinery.

Crane Company, Chicago, Ill., steam valves and fittings, Palace of Machinery.

Crescent Machine Company, Leetonia, Ohio, woodworking machinery, Palace of Machinery.

Crosby Steam Gauge & Valve Company, Boston, Mass., recording instruments, Palace of Machinery.

Cumberland Steel Company, Cumberland, Md., ground shafting, Palace of Machinery.

Cyclops Iron Works, San Francisco, Cal., cranes, Palace of Machinery.

Dannemora Steel Works, Sheffield, England, tool steels, Palace of Machinery.

Denver Engineering Works, Denver, Col., motors, Palace of Machinery.

Detroit Twist Drill Company, Detroit, Mich., tools, Palace of Machinery.

Diamond Expansion Bolt Company, New York, electric line material, Palace of Machinery.

Disston & Sons, Inc., Henry, Philadelphia, Pa., files and metal-cutting saws, Palace of Machinery.

Doak Gas Engine Company, Oakland, Cal., internal-combustion engines, Palace of Machinery.

Dodge Manufacturing Company, Mishawaka, Ind., conveying machinery and power-transmission appliances, Palace of Machinery.

Down, S. G., San Francisco, Cal., compressors, Palace of Machinery.

Dreiss & Krump Manufacturing Company, Chicago, Ill., sheet-metal-working machinery, Palace of Machinery.

Dusenberry & Company, Louis, New York, automobile accessories, Palace of Transportation.

D. & W. Fuse Company, Providence, R. I., fuses, Palace of Machinery.

Eastman Machine Company, Buffalo, N. Y., electric cloth-cutting machines, Palace of Manufactures and Varied Industries.

Economy Engineering Company, Chicago, Ill., hoisting machinery, Palace of Machinery.

Economy Fuse & Manufacturing Company, Chicago, Ill., fuse, Palace of Machinery.

Edison Storage Battery Company, East Orange, N. J., storage batteries, Palace of Machinery.

Edison, Thomas A., East Orange, N. J., automobile accessories, Palace of Transportation.

Electric Products Company, Cleveland, Ohio, storage batteries and charging apparatus, Palace of Machinery and Palace of Transportation.

Electrene Company, New York, fire extinguishers, Palace of Machinery.

Electro-Dynamic Company, Bayonne, N. J., motors, Palace of Machinery.

Englehard, Chas. & Company, Rochester, N. Y., pyrometers, Palace of Mines and Metallurgy.

Fairmont Mining Machinery Company, West Va., electric mine pump, Palace of Mines and Metallurgy.

Falk Company, Milwaukee, Wis., power transmitting machinery, Palace of Machinery.

Fess System Company, San Francisco, Cal., crude-oil burning appliances, Palace of Machinery.

Field Force Pump Company, Elmira, N. Y., pumps and pressure filters, Palace of Machinery.

Fuller & Company, W. P., San Francisco, Cal., lubricating oils, Palace of Machinery.

Fulton Manufacturing Company, Erie, Pa., internal-combustion engines, Palace of Machinery.

Gas Engine & Power Company & Chas. L. Seabury, Con., Morris Heights, N. Y., boilers and internal-combustion engines, Palace of Machinery.

General Electric Company, Schenectady, N. Y., heating appliances, motive power, motors, generators, switching apparatus, steam-flow meters, etc., Palace of Machinery, Palace of Transportation and Palace of Manufactures and Varied Industries.

General Motor Truck Company, Detroit, Mich., motor trucks, Palace of Transportation.

Germantown Tool Works, Philadelphia, linemen's axes, Palace of Machinery.

Gest, G. M., Ltd., Conduit Engineer and Contractor, Montreal, Winnipeg, Vancouver, Palace of Machinery.

Gest, G. M., Conduit Engineer and Contractor, New York, Palace of Machinery.

Gest, Guion M., New York, electric conduit system, Palace of Machinery.

Gibro Machine Company, Oakland, Cal., power punch presses, Palace of Machinery.

Gold Car Heating & Lighting Company, New York, thermostats and electric systems, Palace of Machinery.

Goodyear Tire & Rubber Company, Akron, Ohio, steam and fire hose, Palace of Machinery.

Gould & Eberhardt, Newark, N. J., shapers and gear cutters, Palace of Machinery.

Grant Manufacturing & Machine Company, Bridgeport, Conn., riveting machines.

Graton & Knight Manufacturing Company, Worcester, Mass., leather belting and gaskets, Palace of Machinery.

Grinder Manufacturing Company, The Luther, Milwaukee, Wis., tool grinders, Palace of Machinery.

Hanovia Chemical & Manufacturing Company, Newark, N. J., electric lamps, Palace of Machinery.

Harrison Safety Boiler Works, Philadelphia, Pa., boilers, Palace of Machinery.

Harron, Rickard & McCone, San Francisco, Cal., water-handling appliances, internal-combustion engines, pumps, etc., Palace of Machinery.

Henderson-Willis Company, St. Louis, Mo., oxy-acetylene equipment, Palace of Machinery.

Hendrie & Bolthoff Manufacturing & Supply Company, Denver, Colo., hoist, Palace of Mines and Metallurgy.

Hersey Manufacturing Company, South Boston, Mass., water meters, Palace of Machinery.

Holmes Motor Company, Boston, Mass., internal-combustion engines, Palace of Machinery.

Home Washing Machine Company, Brooklyn, N. Y., washing machines, Palace of Manufactures and Varied Industries.

Hoover Suction Sweeper Company, New Berlin, Ohio, suction sweepers, Palace of Manufactures and Varied Industries.

Hoppes Manufacturing Company, Springfield, Ohio, water heaters, V-notch meters, etc., Palace of Machinery.

Horton & Son Co., The E., Windsor Locks, Conn., lathe and drill chucks, Palace of Machinery.

Hyde Company, Henry C., gasoline-electric lighting system and internal-combustion engines, Palace of Machinery.

Hydraulic Press Manufacturing Company, Mt. Gilead, Ohio, power pumps and valves, Palace of Machinery.

Imperial Gas Engine Company, San Francisco, Cal., internal-combustion engines, Palace of Machinery.

Industrial Instrument Company, Foxboro, Mass., recording and testing instruments, Palace of Machinery, Palace of Transportation, Palace of Mines and Metallurgy and Palace of Manufactures and Varied Industries.

Ingersoll-Rand Company, New York, N. Y., air compressors, Palace of Mines and Metallurgy.

International Acheson Graphite Company, Niagara Falls, N. Y., lubricants, graphite electrodes and model electric furnace, Palace of Mines and Metallurgy.

International Harvester Company of America, Chicago, Ill., internal-combustion engines, apparatus for lifting and handling water, etc. Palace of Machinery and Palace of Manufactures and Varied Industries.

Innovation Electric Company, New York, vacuum cleaners, Palace of Manufactures and Varied Industries.

Interstate Electric Novelty Company, New York, automobile accessories and flashlamps, Palace of Transportation.

Jahnke Welding & Manufacturing Company, San Francisco, Cal., oxy-acetylene equipment, Palace of Machinery and Palace of Mines and Metallurgy.

Kempsmith Manufacturing Company, Milwaukee, Wis., milling machines, Palace of Machinery.

Kewanee Private Utilities Company, Kewanee, Ill., vacuum cleaners, gasoline storage system, Palace of Manufactures and Varied Industries and Palace of Machinery.

Krogh Manufacturing Company, San Francisco, Cal., centrifugal and turbine pumps, Palace of Machinery.

Lagonda Manufacturing Company, Springfield, Ohio, boiler fittings, water strainers, valves, etc., Palace of Machinery.

Landis Tool Company, Waynesboro, Pa., grinding and boring machines, Palace of Machinery.

Lea-Coutensy Company, New York, cold-steel saws, Palace of Machinery.

Link-Belt Company, Philadelphia, Pa., link-belt silent chains and chain drives, Palace of Machinery.

Loew-Victor Engine Company, Chicago, Ill., internal-combustion engines, Palace of Machinery.

Loraine Steel Company, Johnstown, Pa., electric track welding, Palace of Mines and Metallurgy.

Lucey Company, J. F., Pittsburgh, Pa., pumps, Palace of Machinery.

Luitweiler Pumping Engine Company, Rochester, N. Y., pumps, Palace of Machinery.

Lunkenheimer Company, Cincinnati, Ohio, oiling devices and grease cups, Palace of Machinery, Palace of Transportation and Palace of Manufactures and Varied Industries.

McIntosh & Seymour Corporation, Auburn, N. Y., internal-combustion engines and steam engines, Palace of Machinery.

McGraw Publishing Company, New York, engineering publications, Palace of Machinery.

MacLeod Company, Cincinnati, Ohio, oil burners, sand-blast machines, heaters, etc., Palace of Machinery.

Marland, W. J., Oakland, Cal., thermostats, water valves, pipe-fitters' tools and electric lanterns, Palace of Machinery and Palace of Manufactures and Varied Industries.

Meese & Gottfried Company, San Francisco, Cal., conveying and elevating machinery, Palace of Machinery.

Mietz, August, New York, internal-combustion engines, Palace of Machinery.

Mine Safety Appliance Company, Pittsburgh, Pa., pressure and recording gages, Palace of Machinery.

Minnesota Manufacturers' Association, North St. Paul, Minn., conveying machinery, Palace of Machinery.

Mitts & Merrill, Saginaw, Mich., key-seating machines, Palace of Machinery.

Mohrlite Company, San Francisco, Cal., electric lamps and lighting system, Palace of Machinery.

Moloney Electric Company, St. Louis, Mo., sign-lamp transformers, Palace of Machinery.

Morton Manufacturing Company, Muskegon Heights, Mich., machine tools, Palace of Machinery.

Muggley Wheel Corporation, New York, differential wheels, Palace of Machinery.

National Brake & Electric Company, Milwaukee, Wis., air compressors, Palace of Machinery.

National Meter Company, New York, water meters, Palace of Machinery.

National Tube Company, Pittsburgh, Pa., tubing, pipes and fittings, Palace of Machinery and Palace of Manufactures and Varied Industries.

Nelson Valve Company, Philadelphia, Pa., valves, Palace of Machinery.

Neptune Meter Company, New York, water meters, Palace of Machinery.

New London Ship & Engine Company, Groton, Conn., internal-combustion engines and air compressors, Palace of Machinery.

Neuland Electric Company, San Francisco, Cal., electric generators, Palace of Machinery.

Niagara Machine & Tool Works, Buffalo, N. Y., sheet-metal-working tools and machinery, Palace of Machinery.

"1900" Washer Company, Binghamton, N. Y., washing machines, Palace of Manufactures and Varied Industries.

Ohio Electric Car Company, Toledo, Ohio, automobiles, Palace of Transportation.

Ohlen & Sons Saw Manufacturing Company, J., Columbus, Ohio, pipe-cutting and threading machines, Palace of Machinery.

Olsen Testing Machine, Tinius, Philadelphia, Pa., dynamometers and machines, Palace of Machinery.

Pacific Tank & Pipe Company, San Francisco, Cal., feed-water tanks, piping and special lathes, Palace of Machinery.

Pacific Electric Manufacturing Company, San Francisco, Cal., switches and circuit breakers, Palace of Machinery.

Paraffine Paint Company, San Francisco, Cal., insulating tapes and compounds, Palace of Manufactures and Varied Industries.

Peerless Marine Motor Company, Buffalo, N. Y., internal-combustion engines, Palace of Machinery.

Pelton Water Wheel Company, San Francisco, Cal., pumps, water wheels and recording instruments, Palace of Machinery.

Pennsylvania Flexible Metallic Tubing Company, Philadelphia, Pa., flexible metallic tubing, Palace of Machinery.

Pignolet, Louis M., New York, electrical instruments, Palace of Machinery.

Plant Rubber & Supply Company, San Francisco, Cal., asbestos, Palace of Machinery.

Pnumercator Company, New York, water-tank indicator, Palace of Machinery.

Pratt & Cady Company, Hartford, Conn., boiler valves, Palace of Machinery.

Pyrene Manufacturing Company, New York, N. Y., fire extinguishers, Palace of Machinery and Palace of Mines and Metallurgy.

Quality Saw & Tool Works, Chicago, Ill., hack saws, Palace of Machinery.

Ray Manufacturing Company, W. S., San Francisco, Cal., oil-burning systems, Palace of Machinery.

Reed Manufacturing Company, Erie, Pa., vises, dies and pipe cutters, Palace of Machinery.

Reeves Pulley Company, Columbus, Ind., transmission device, Palace of Machinery.

Robbins & Myers, Springfield, Ohio, motors and fans, Palace of Machinery and Palace of Manufactures and Varied Industries.

Robinson & Son Company, Wm. C., Baltimore, Md., lubricants, Palace of Machinery.

Rockford Machine Tool Company, Rockford, Ill., drill presses, Palace of Machinery.

Sangamo Electric Company, Springfield, Ill., meters and small lighting units, Palace of Transportation and Palace of Machinery.

Saginaw Manufacturing Company, Saginaw, Mich., pulleys, Palace of Machinery.

Schaeffer & Budenberg Manufacturing Company, Brooklyn, N. Y., indicating and recording instruments, Palace of Machinery

Schieren, Chas. A., New York, leather belting, Palace of Machinery.

Schleuter, M. L., Chicago, Ill., floor-surfacing machines, Palace of Machinery.

Searles, Mailler, San Francisco, Cal., conveying machinery, Palace of Machinery.

Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., electric cranes and hoists, Palace of Machinery.

Simonds Machinery Company, San Francisco, Cal., pumps and compressors, Palace of Machinery.

Simonds Manufacturing Company, Fitchburg, Mass., saws, Palace of Machinery.

Slaughter Company, W. E., Chicago, Ill., electro-thermal appliances, Palace of Manufactures and Varied Industries.

Smith Manufacturing Company, A. P., East Orange, N. J., water-works machinery, Palace of Machinery.

Smith & Mills Company, Cincinnati, Ohio, machine tools, Palace of Machinery.

Smith & Watson Iron Works, Portland, Ore., oil-burning equipment, Palace of Machinery.

Spear & Son Company, Aldean, Boston, Mass., grinding and abrasive materials, Palace of Machinery.

Spencer Turbine Cleaner Company, Hartford, Conn., vacuum-cleaning apparatus, Palace of Manufactures and Varied Industries.

Splitdorf Electrical Company, Newark, N. J., automobile accessories, Palace of Transportation.

Standard Gas Engine Company, San Francisco, Cal., internal-combustion engines, Palace of Machinery.

Standard Oil Company, San Francisco, Cal., lubricating oils, Palace of Machinery.

Standard Pressed Steel Company, Philadelphia, Pa., steel-shaft hangers and set collars, Palace of Machinery.

Standard Woven Fabric Company, Framingham, Mass., woven belting, friction brake lining and automobile accessories, Palace of Machinery and Palace of Transportation.

Standard Underground Cable Company, Pittsburgh, Pa., insulating materials, wire-braiding machines, wires and cables, Palace of Machinery, Palace of Transportation and Palace of Manufactures and Varied Industries.

Stockbridge Machine Company, Worcester, Mass., machine tools, Palace of Machinery.

Stokvis' Koninklyke Fabriek Van Metaalwerken, W. J., Arnheim, Netherlands, lighting fixtures.

Sumter Electric Company, Sumter, S. C., automobile accessories, Palace of Transportation.

Superior Corundum Wheel Company, Waltham, Mass., grinding and abrasive materials, Palace of Machinery.

Temco Electric Motor Company, Leipsic, Ohio, electric tools and small motors, Palace of Machinery.

Thomas & Sons Company, R., East Liverpool, Ohio, insulators, Palace of Machinery.

Thordarson Electric Manufacturing Company, Chicago, Ill., electrical instruments, transformers, Palace of Machinery.

Trumbull Electric Manufacturing Company, Plainville, Conn., insulating material, Palace of Machinery.

Union Caliper Company, Orange, Mass., mechanics' tools, Palace of Machinery.

Union Oil Company of California, San Francisco, asphalt for insulating, Palace of Manufactures and Varied Industries and Palace of Machinery.

Union Switch & Signal Company, Swissvale, Pa., railway equipment, Palace of Transportation.

United Pump & Power Company, Milwaukee, Wis., pneumatic water-pumping system, Palace of Machinery.

United States Electrical Tool Company, Cincinnati, Ohio, electric drills, Palace of Machinery.

United States Light & Heating Company, Niagara Falls, N. Y., automobile accessories, storage batteries and small lighting outfits, Palace of Machinery and Palace of Transportation.

United States Steel Corporation. Pittsburgh, Pa., transmission line material and tool steels, Palace of Machinery.

Venn-Severin Company, Chicago, Ill., internal-combustion engines, Palace of Machinery.

Warner & Swasey Company, Cleveland, Ohio, machine tools, Palace of Machinery.

Waterman Marine Motor Company, Detroit, Mich., internal-combustion engines, Palace of Machinery.

Watson-Stillman Company, New York, hydraulic packing, Palace of Machinery.

Western Electric Company, San Francisco, Cal., generators, Palace of Machinery.

Western Gas Engine Corporation, Los Angeles, Cal., internal-combustion engines, Palace of Machinery.

Western Tool & Manufacturing Company, Springfield, Ohio, machine-shop accessories, Palace of Machinery.

Western Transformer Company, East Oakland, Cal., transformers, Palace of Machinery.

Westinghouse Air Brake Company, Pittsburgh, Pa., air compressors, Palace of Machinery.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., turbines, insulating material, motors, generators, mercury rectifiers, transformers, lamps, instruments, switching apparatus, electric locomotives, automobile accessories, etc., Palace of Machinery, Palace of Mines and Metallurgy, Palace of Transportation and Palace of Manufactures and Varied Industries.

Westinghouse Lamp Company, Bloomfield, N. J., tungsten lamps, Palace of Machinery.

Westinghouse Machine Company, East Pittsburgh, Pa., turbines and condensers, Palace of Machinery.

Westinghouse Pacific Coast Brake Company, San Francisco, Cal., air compressors, Palace of Machinery.

Westinghouse Traction Brake Company, Pittsburgh, Pa., air compressors, Palace of Machinery.

Williams Tool Company, Erie, Pa., pipe-threading machines, Palace of Machinery.

Witherby Igniter Company, Springfield, Mass., Palace Mines and Metallurgy.

Wood, R. D., & Company, Philadelphia, Pa., hydraulic machinery, Palace of Machinery.

Worthington, Henry R., New York, pumps, Palace of Machinery.

Yarnall-Waring Company, Philadelphia, Pa., steam and water valves, Palace of Machinery.

Young, C. J., Iron Works, Seattle, Wash., machinery, Palace of Machinery.

NEW YORK METAL MARKET PRICES

	March 16 Selling Prices Bid	Asked	March 22 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot*	66 0 0		68 5 0	
Prime Lake	14.85	to 15.00	.....	to 15.12½
Electrolytic	14.70	to 14.90	.....	to 15.12½
Casting	14.12½	to 14.37½	.....	to 14.37½
Copper wire base	15.87½		15.87½	
Lead	4.10		4.10	
Nickel	42.00	to 45.00	42.00	to 45.00
Sheet zinc, f.o.b. smelter	13.50		13.50	
Spelter	9.62½		9.75†	
Straits tin	52.00†		53.50†	
Aluminum, 98 to 99 per cent.	19.00		18.75	

*OLD METALS

Heavy copper wire	13.00	13.50
Brass, heavy	9.00	9.25
Brass, light	7.75	7.75
Lead, heavy	3.65	3.85
Zinc, scrap	7.75	7.50

COPPER EXPORTS*

Total tons to March 22 22,790

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Cowgill Garage & Light Company, of Cowgill, Mo., has been incorporated with a capital stock of $8,000 by R. A. Thompson, O. C. Switzer and Otis Lashley.

The Jefferson Electric Company, of Jefferson, Ga., has been granted a charter with a capital stock of $10,000. The incorporators are W. H. Smith, H. T. Hobley, J. E. Randolph and others.

The Continental Power Company, of Birmingham, Ala., has been incorporated with a capital stock of $2,000. The officers are: H. B. Wheelock, president and treasurer; D. E. Manasco, vice-president, and R. H. Wood, secretary.

New Industrial Companies

The Motor-Accessory Distributing Company has filed articles of incorporation under the laws of Maine, with a capital stock of $100,000, for the purpose of manufacturing and dealing in mechanical and electrical devices for ignition and other electrical devices. S. Titcomb is president.

The Davison-Namack Engine Corporation, of Ballston Spa, N. Y., has been chartered with a capital stock of $50,000 to manufacture and deal in engines and tools for generation and transmission of power. The incorporators are Ralph H. Davison, W. Namack and S. I. Foster, of Amsterdam.

The Phelps Heating Specialty Company, of New York, N. Y., has been incorporated by R. A. Koontz, H. J. Neuschafer and C. S. Ashley, 295 Broadway, New York, N. Y. The company is capitalized at $50,000 and proposes to manufacture machinery, etc., connected with electric or other power plants.

Trade Publications

Wiring Devices.—Pass & Seymour, Inc., Solvay, N. Y., have issued two leaflets designated as 58 A and 58 B which describe several types of its fuseless rosettes.

Electric Pyrometers.—The Wilson-Maeullen Company, 1 East Forty-second Street, New York, has prepared a catalog which describes its electric pyrometers.

Outlet Boxes and Covers.—Bulletin No. 250 just issued by the National Metal Molding Company, Pittsburgh, Pa., describes and illustrates its outlet boxes and covers.

Illuminating Glassware.—The Haskins Glass Company, Chicago, Ill., is sending out its new No. 7 catalog, which shows various designs and styles of glassware for illumination.

Electric Vehicles.—The Andover Motor Vehicle Company, Andover, Mass., has prepared a catalog which describes and illustrates several types of electrically operated automobiles and trucks.

Series Mercury-Arc Rectifier Outfit.—The General Electric Company, Schenectady, N. Y., has just issued Bulletin No. 43,900, describing its combined unit series mercury-arc rectifier apparatus.

Fixtures for Nitrogen-Filled Lamps.—The National Lighting Products Company, Jenkins Arcade, Pittsburgh, Pa., is sending out a folder which describes its fixtures for high-efficiency incandescent lamps.

Pulley Covering.—A folder describing a compound for covering pulleys to keep the belt from slipping has just been issued by the "Gripwell" Pulley Covering Company, 601 Candler Building, New York.

Tungsten Lamps.—The General Electric Company is sending out a folder entitled "Have You Learned Your Lesson?" which directs attention to some of the advantages of its various types of tungsten lamps.

Wires and Cables.—The M. B. Austin & Company, Chicago, Ill., is sending out a number of loose leaves describing various types of wire, cable and wiring devices which are to replace loose leaves previously sent out.

Lighting Fixtures.—Catalog No. 18, issued by the New York Gas & Electric Appliance Company, 569 Broadway, New York, entitled "Lighting Fixtures of Distinction," is an attractive 184-page book which describes and illustrates a large number of lighting fixtures.

Construction News

New England

SALEM, N. H.—The Salem Lt., Ht. & Pwr. Co. expects to erect within the next two months 4 miles of transmission lines; also to purchase one 75-kw, single-phase, 60-cycle, 2200-volt generators, 50 5-amp. single-phase, 60-cycle meters, and heating and cooking apparatus, vacuum cleaners, etc. The company contemplates establishing a day service. Post office address, Salem Depot, Salem. E. R. Woodbury is manager.

CHICOPEE, MASS.—Within the next two months the electric-light committee expects to purchase about 10 ornamental lamp standards and equipment for inverted street arc-lamp lighting system. H. L. Burnett is manager of the municipal electric-light plant.

EAST BRIDGEWATER, MASS.—The Edison El. Illg. Co. of Brockton expects to purchase within the next three months three 300-kva transformers, three 15,000-volt oil switches, four feeder panels, two three-phase electrolytic lightning arresters and 30 15,000-volt disconnecting switches. A. F. Nelson is manager.

FALMOUTH, MASS.—The Buzzards Bay El. Co., of Falmouth, expects to construct two substations with an output of about 200 kw within the next five months. Material for 11 miles of 33,000-volt transmission line has been purchased by the company. C. H. Carpenter is treasurer.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 10, for roofing, sheet-metal work, plumbing, heating and lighting, etc., for new building at the naval torpedo station, Newport, R. I. Also for furnishing two 2½-ton, three-motor traveling cranes and one movable bridge, delivered and erected at the naval torpedo station, Newport, R. I. Plans and specifications may be obtained upon application to the above bureau or to the commandant of the naval station named.

Middle Atlantic

ALBANY, N. Y.—The Municipal Gas Co., of Albany, has taken out a permit for the construction of a steam-driven electric-power plant in North Albany for use in emergencies in case of failure in the delivery of power from the Spier Falls. The cost of the plant is estimated at about $60,000.

ANTWERP, N. Y.—Surveys are being made by the Antwerp Lt. & Pwr. Co. for the erection of a transmission line from Antwerp to Gouverneur, a distance of about 10 miles. When completed the company will supply electricity in Gouverneur and to farmers residing along the line. The line will be tapped at Dickinson's Corners, and an extension will be made to Oxbow, where electrical service will be supplied.

AUBURN, N. Y.—The erection of 30 miles of telephone line in connection with its transmission system is reported to be under consideration by the Empire Gas & El. Co. of Geneva; also the construction of an additional 5 miles of steel-power transmission lines. The company also contemplates the installation of transformers (1000-kw rating) in the Geneva plant, to connect with the 13,000-volt transmission line.

INDUSTRY, N. Y.—Bids will be received by Mrs. Warham Whitney, president of the board of managers of the State Agricultural and Industrial School, Industry, N. Y., until April 13 for alterations and additions to hospital buildings, including construction, heating, plumbing, drainage and electric work. Drawings and specifications may be consulted at the State Agricultural and Industrial School, Industry, N. Y.; at the New York office of the Department of Architecture, 1224 Woolworth Building, and at the Department of Architect, Capitol, Albany.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 21 for the installation of an intercommunicating telephone system for the offices of the United States district attorney in the United States court house and post office in New York, N. Y. For details see proposal columns.

NEW YORK, N. Y.—Bids will be received by the Board of Trustees of Bellevue and Allied Hospitals, 415 East Twenty-sixth Street, New York, until April 2 for furnishing and installing all lighting fixtures in pavilions "I" and "K" of the new Bellevue Hospital. Blank forms and further information may be obtained at the office of the contract clerk and auditor, 400 East Twenty-ninth Street, New York.

NEW YORK, N. Y.—Bids will be received by Patrick Jones, superintendent of school supplies, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until March 30 for furnishing and delivering to each school electrical, metal-working, science, wood-working and miscellaneous supplies for the day high, evening technical and trade and vocational schools of the city of New York. Blank forms and further information may be obtained at the above office.

PATCHOGUE, N. Y.—Within the next two months the Patchogue El. Lt. Co. expects to purchase a Green fuel economizer. Ralph R. Hawkins is manager.

WATERVLIET, N. Y.—At a meeting of the taxpayers held recently it was voted to bond the city for $20,000 for improvements to the municipal electric-light plant (new equipment, including generators and other electrical apparatus will be required), rebuilding the distribution system, new street lamps, new smokestack, etc. J. J. Keis is city engineer.

CREIGHTON, PA.—The Council of East Deer Township is considering a proposal submitted by the West Penn Ry. & Ltg. Co. for installing an electric-lighting system in the town of Creighton. The cost of the proposed system is estimated at $125,000.

HOLMESBURG, PA.—The Department of Charities has awarded the contract for furnishing and installing the electric equipment in the power house at the Home for the Indigent at Holmesburg to the Thompson El. Co., 1606 Sansom St., Philadelphia, at $32,000.

PITTSBURGH, PA.—The Public Service Commission has approved the contract of the Duquesne Lt. Co., of Pittsburgh, for lighting Ross Township, which includes street-lighting service.

PITTSBURGH, PA.—The Carnegie Steel Co., of Pittsburgh, it is reported, will soon begin work on the construction of a steel-tie plant in Homestead, to cost about $500,000. The electrical contracts, it is understood, will be awarded in the near future.

SOMERSET, PA.—Contracts have been signed by the Somerset Ry. Co., of Somerset, and the Penn El. Co., of Johnstown, whereby the latter will furnish energy to operate the system of the railway company. The right-of-way for the entire distance from Somerset to Rockwood has been secured and construction work will probably begin as soon as the weather permits. G. C. Winslow is general manager and chief engineer of the railway company.

YORK, PA.—Bids will be received by C. P. Shreiner, city clerk, City Hall, York, until April 2 for construction of sewage-disposal work and pumping station under contract "A," and for furnishing and installing machinery under contract "B," as follows: Contract "A" includes three settling tanks with outside measurements about 83 ft. square and 28 ft. deep, with appurtenances and a pumping-station building, having concrete substructure and brick substructure 26 ft. wide by 58 ft. long. Contract "B" will include furnishing and installing all operating machinery, consisting of three 5,000,000-gal. motor-driven pumps, one 10,000,000-gal. gasoline-engine-driven pump, and various appurtenances. Plans and specifications may be obtained at the office of George W. Fuller, consulting engineer, 170 Broadway, New York, N. Y., and at the office of the city engineer, city hall, York, Pa., upon deposit of $10, which will be refunded upon return of same.

ATLANTIC CITY, N. J.—Mayor Riddle and Director of Parks Bacharach have authorized estimates of cost prepared for the installation of ornamental lamps on the streets extending from the Boardwalk to Atlantic Avenue.

ATLANTIC CITY, N. J.—Plans have been prepared for an extension (six stories high) to the Hotel Strand in Atlantic City. The electrical contract, it is understood, will be awarded during the summer. Howard Edwards is manager.

BURLINGTON, N. J.—The Common Council has authorized plans prepared for the installation of a new pumping station at the city water-works station. A resolution formerly adopted provides for changing the motive power from steam to electricity.

HOBOKEN, N. J.—The report submitted to the City Council by Joseph P. McBride, electrical engineer, recommends the establishment of a municipal electric-light plant, to cost about $50,000.

JERSEY CITY, N. J.—Property owners and merchants of Grove Street are negotiating with the Board of City Commissioners for the installation of an ornamental lighting system along that thoroughfare.

NEWARK, N. J.—A power plant will be installed in the new golf-ball manufacturing plant to be erected by the St. Mongo Mfg. Co. on Sylvan Avenue. James P. Scrimshaw is architect.

NEWARK, N. J.—The Roseville Improvement Association is negotiating with the Board of Public Works for the installation of a new street-lighting system on Orange Street. The plans provide for nitrogen lamps, to be installed by the Pub. Ser. El. Co.

PATERSON, N. J.—The installation of an electric light and power plant in the high school has been recommended by Commissioner David G. Smith of the board of education. The cost of the proposed plant is estimated at $4,600, which would have sufficient output to furnish electrical service to the high school, School No. 23, the court house and the federal building.

PERTH AMBOY, N. J.—The City Council has engaged Runyon & Carey, 845 Broad Street, Newark, N. J., to prepare plans for the proposed municipal electric-light plant, to cost about $125,000.

BALTIMORE, MD.—The contract for furnishing and installing the additional 500-kw turbo-generator outfit in the high-pressure pumping station has been awarded to Richard Morton, of Baltimore. The equipment is to consist of a Kerr turbine and a General Electric (Fort Wayne type) generator, with reduction gear (7½ to 1). Lester L. Kingsbury is chief electrical inspector.

LONACONING, MD.—Within the next two months the Home El. Lt. Co., of Lonaconing, expects to erect a substation for distribution of energy received at 33,000 volts; also for rebuilding distribution system and consolidating the plant and system of the Lonaconing El. Lt. & Pwr. Co., which was recently taken over by the Home company. J. Somerville is manager.

WILLIAMSON, W. VA.—The electric plant of the Williamson Lt. & Ice Co. was completely destroyed by fire on March 4. The company will build a temporary plant, to use until transmission line is completed, and will change ice plant to use raw instead of distilled water. The Tug River Pwr. Co. will erect within the next 60 days a transmission line and an aerial substation with an output of from 200 kw to 250 kw to supply electricity to the Williamson Lt. & Pwr. Co.

ALEXANDRIA, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 19 for a vacuum cleaning apparatus in the custom house and post office at Alexandria, Va. For details see proposal columns.

LYNCHBURG, VA.—Bids will be received by the Council committee on water, Krise Building, Lynchburg, until April 6 for the installation of an emergency pumping station and booster pump as follows: (1) Two brick buildings; (2) three centrifugal pumps; (3) transformers, motors and other electrical equipment; (4) cast-iron pipe, valves, etc.; (5) liquid chlorine apparatus. H. L. Shaner is city engineer.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until March 29 for furnishing 800 wall telephones and 200 desk telephones. For further information apply to the chief signal officer.

WASHINGTON, D. C.—Bids will be received by the superintendent of the Coast and Geodetic Survey, 205 New Jersey Avenue, S. E., Washington, D. C., until April 3 for furnishing and installing a complete electric substation outfit. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until March 29, for furnishing, under Proposal 753, paper-insulated, submarine lead-covered and armored cable as follows: 7730 ft. type 305, five-pair; 26,000 ft. type 322, 15-pair; 18,800 ft. type 324, 20-pair; 12,000 ft. type 327, 50-pair; also for furnishing paper-insulated aerial lead-covered cable as follows: 60,000 ft. type 401, 10-pair; 22,300 ft. type 403, 20-pair; 5000 ft. type 405, 30-pair; 2000 ft. type 407, 50-pair; 2000 ft. type 409, 100-pair, and 4825 ft. type 411, 10-pair. For further information address Charles S. Wallace, captain signal corps, U. S. A.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 15,692—An American consular officer in Europe reports that an electrical firm in his district wishes to represent American manufacturers of vulcanized fiber. It is stated that the firm uses large quantities of this

material and wishes to secure an agency for Europe. No. 15,972—The Bureau of Foreign and Domestic Commerce is in receipt of a communication from an American chamber of commerce in a foreign country stating that it has been called upon to supply names and addresses of manufacturers and exporters of copper and brass plates, sheets, rods, tubes, wire, etc. No. 15,971—An American company owning and operating an electric-light plant in Central America has informed an American consular officer that it is contemplating the installation of similar plants in other cities in that country. No. 15,976—An import agent in one of the neutral countries has informed an American consular officer that he desires cable quotations for prompt delivery of 200 tons of electrolytic copper in bars. He will pay cash f.o.b. vessel New York. No. 16,002—An American consular officer in southern Europe reports that an importing firm in his district desires to secure an exclusive agency for the sale of American drawn-wire electric-light globes. The globes should be 0.5 watt and 1 watt per candle. Correspondence should be in French or Italian. No. 16,106—An American consul in Russia reports that a firm of agents and importers in his district wishes to represent American manufacturers of textile machinery, laundry and ventilating machinery, malleable fittings and pipes, steam and water turbines, electrical machinery, etc. Correspondence may be in English. No. 15,991—An American consul in Russia has received a communication from a railway engineer stating that he desires to get in touch with American manufacturers of electrical and plumbing supplies, pumps, boilers, road-making machinery, fire engines and extinguishers, etc. Correspondence may be in English.

North Central

BATTLE CREEK, MICH.—Bids, it is reported, are being received by the city clerk for two 8-in. pumps, with necessary motors and transmission lines to the water-works plant.

HARTFORD, MICH.—A new corporation has been organized under the name of the Hartford Lt. & Pwr. Co. to take over the electric plant and property owned by Anderson Brothers. The company is planning to install a new generator this spring and make other improvements to the system. The principal stockholders are E. Anderson, Julius Anderson and Marion Anderson.

LAPEER, MICH.—The City Council has decided to submit to the voters the proposal to issue $20,000 in bonds for the installation of a municipal electric-light plant.

OTTER LAKE, MICH.—The village of Otter Lake has granted a franchise to Carl Tinker and Stanley Wilcox, both of Lapeer, to construct and operate an electric-light plant here. Electricity to operate the system will be secured from the transmission line of the Commonwealth Pwr. Co. at Mount Morris. As soon as the system is in operation the transmission lines will be extended to Fostoria and Otisville to supply electrical service to those two towns.

PONTIAC, MICH.—The Pontiac Pwr. Co. has submitted a proposition to the City Council for renewal of the street-lighting contract, providing for both improved arc lamps and ornamental boulevard lamps. The company offers to replace the present arc lamps with 600-cp Mazda lamps, of which the contract calls for not fewer than 240, and at least 75 ornamental lamps for a period of ten years.

ATHENS, OHIO.—The installation of an ornamental lighting system on Court Street is under consideration, the cost of installing and maintaining same to be paid by the property owners.

CANTON, OHIO.—The Ohio State Tel. Co. is planning to make improvements to its system in Canton and vicinity, to cost about $35,000. The company also contemplates improvements to its system in other parts of the State, involving an expenditure of about $1,500,000. Several exchanges will be entirely rebuilt, including the one at Alliance, where $100,000 will be spent, and that at Massillon, where $75,000 will be expended.

CINCINNATI, OHIO.—The contract for the electrical equipment for the new Hamilton County court house, which will cost about $2,000,000, has been awarded to the Charles McCall Co., of Philadelphia, Pa.

CLEVELAND, OHIO.—The purchase of a high-pressure, duplex feed pump for the municipal electric-light plant has been recommended to the City Board of Control by F. W. Ballard, commissioner of light and heat.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, 511 City Hall, Cleveland, until April 2 for furnishing one auto-truck for the division of the police. Specifications may be obtained at the office of director of public safety, Room 207, City Hall.

DAYTON, OHIO.—The County Commissioners are considering a proposal submitted by the Dayton Pwr. & Lt. Co. for lighting a section of public road, which if satisfactory may be adopted for general use in the county.

FINDLAY, OHIO.—The Board of Control has awarded the Toledo, Bowling Green & Southern Trac. Co. a contract for street-lighting, under the terms of which the company is to install new street lamps.

GREENVILLE, OHIO.—The Greenville El. Lt. & Pwr. Co. is preparing to extend its electrical service to the towns of Verona, Prebel County and Gordon, Darke County. This will require the erection of a 6-mile transmission line, which will serve about 800 people. The street-lighting contracts call for 26 lamps. The Brookville & Lewisburg Ltg. Co. has taken the contract for street-lighting and power service within the municipalities, the Greenville Company serving this company at the corporation limits of each of the towns.

PORT CLINTON, OHIO.—Negotiations are under way between the City Council and the Port Clinton El. Lt. & Pwr. Co. for improving the lighting system in the business district. It is proposed to double the number of lamps now in use.

DIXON, KY.—The Clay Lt. & Ice Co., of Clay, is contemplating extending its transmission line to Dixon to supply electricity in this vicinity.

HAZARD, KY.—The local electric-light plant and franchise, it is reported, has been purchased by H. L. Stone, of Pikeville, and associates.

GREENFIELD, IND.—Bids will be received by the city clerk, Greenfield, until April 7 for one engine or turbine and a 180-kva alternating-current generator (directly connected) and exciter with the necessary switchboard equipment for same. Specifications may be secured upon application to E. C. Wolfe, superintendent to the municipal electric-lighting plant.

LEBANON, IND.—The City Council, it is reported, has adopted the specifications prepared by Prof. Topping, of Purdue University, for a street-lighting system. Contracts for construction of the work, it is understood, will be awarded April 12.

MILLTOWN, IND.—The Town Trustees have granted the El. Ser. Co. a franchise to install and operate an electric-lighting plant in Milltown. The contract for street-lighting provides for sixty 60-watt lamps at $720 per year. David S. Cook, Henry S. Gray, William S. Speed and others are interested in the company.

BLOOMINGTON, ILL.—The installation of a cluster-lamp lighting system from the square to the Chicago & Alton Railroad station is under consideration.

LUDLOW, ILL.—A committee, consisting of L. N. Bear, Charles Walker and William New, has been appointed to make investigations relative to the installation of an electric-lighting system in Ludlow.

SPRINGFIELD, ILL.—The City Commissioners have authorized bids advertised for a 750-kva generator to be installed at the water-works pumping station.

BELOIT, WIS.—The Wisconsin Commission has authorized the Beloit Wtr., Gas & El. Co. to issue $100,000 in bonds to provide funds for extensions and improvements to its system.

BERLIN, WIS.—The Central Wisconsin Ry. & Utilities Co. has been authorized by the Wisconsin Commission to issue $10,000 in capital stock for the purpose of purchasing a right-of-way and for material for the construction of a transmission line from Berlin to Red Granite.

GREEN BAY, WIS.—The Wisconsin Pub. Ser. Co. is contemplating the construction of a hydroelectric plant at Johnson Falls, above Green Bay, to cost about $300,000, during the coming year. Clement C. Smith, of Milwaukee, is president.

OOSTBURG, WIS.—Within the next 30 days H. W. Le Mahrin, owner of the local electric-light plant, expects to purchase a motor-generator set and frequency changer and transformers, 2300/220 volts.

CHISHOLM, MINN.—Within the next six months the Chisholm El. Co. expects to erect a new power station and to purchase one 350-hp boiler and material for extensions to street-lighting (arc-lamp) system; also line supplies and transformers in various sizes, approximately 600 kw. R. M. Heskett is manager.

CROOKSTON, MINN.—The City Council is considering the establishment of a municipal electric-light plant. The 30-year franchise of the local company has expired, and the city has the option of purchasing or renewing the franchise for another 30 years.

KENYON, MINN.—Bids will be received at the office of Dr. J. A. Gates, president of the board of the Independent School District No. 91, Kenyon, until April 5 for construction of the new high and grade school, including general construction, heating and plumbing, electrical work and fixtures, manual training, domestic science and gymnasium equipment.

VIRGINIA, MINN.—Within the next two months the Water and Light Department expects to purchase two 2000-gal.-per-minute, motor-driven turbine pumps, directly connected to 100-hp motors; also material for the erection of 2 miles of three-phase, 2300-volt transmission line. C. T. Harding is superintendent.

CHARLES CITY, IA.—The Charles City & Western R. R. Co., of Charles City, has awarded contracts for extension of its railroad and for equipping it for electrical operation. Contracts have been awarded for a 40-ton electric locomotive, two steel passenger cars and other equipment.

KANSAS CITY, MO.—The Bachelors' Laundry, for which contracts will soon be awarded, will be equipped with electric motor-driven machinery. Madorie & Birdsell, of Kansas City, are architects.

POPLAR BLUFF, MO.—Plans and specifications for a municipal electric-lighting plant, it is reported, are being prepared by the Fuller Construction Co., of St. Louis, Mo. The proposal to issue $75,000 in bonds for same, it is understood, will soon be submitted to the voters.

ST. LOUIS, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 23 for an ammonia refrigerating machine, etc., in the United States post office at St. Louis, Mo. For details see proposal columns.

CRESCO, NEB.—A special election will be held April 6 to submit to the voters the proposal to issue $5,000 in bonds for the installation of a municipal electric-lighting system.

WYNOT, NEB.—Within the next six months the managers of the municipal electric-lighting plant expect to purchase some 110-volt direct-current meters. L. C. Walling is city engineer.

ANTHONY, KAN.—The Anthony Ice & Salt Co. has applied for a franchise to install an electric-lighting system in Anthony. Alfred E. Dent is manager.

ELLSWORTH, KAN.—Within the next three months the People's El. Lt. & Pwr. Co. expects to purchase a 200-kw alternating-current generating unit, consisting of engine and generator, and switching devices; also 250 poles. T. C. Miller is manager.

FREDONIA, KAN.—The Fredonia Ice & Lt. Co. will install an additional generating unit of about 150 kw. The company has not yet decided whether to use a steam or oil engine. J. F. Hollis is president.

PORTIS, KAN.—The installation of a municipal electric-lighting system in Portis is under consideration. The city has voted to erect a transmission line from Downs to supply electricity here.

TOPEKA, KAN.—The bill, which provides for the illumination of the State House grounds, and authorizes an expenditure of $9,750 in equipment, has been signed by Governor Capper. The plans provide for the erection of 40 standards in the grounds and 28 along the driveways. The city will maintain the lamps.

Southern States

CARY, N. C.—Bonds, not to exceed $20,000, it is reported have been authorized to install a municipal electric-light plant in Cary.

KINSTON, N. C.—Bids will be received by the Mayor and City Council of Kinston, N. C., until April 6 for improvements to the municipal electric-light plant as follows: 300-kw (engine-type) generators, two belted generators, switchboard, 450-hp four-valve engine, condenser, centrifugal pump and motor, and return tubular boilers. Bids on alternates to the above will be considered. Specifications, proposal form, etc., are on file in the office of the city clerk, Kinston, and may be obtained upon application to Gilbert C. White, consulting engineer, Charlotte, N. C., upon deposit of $5, to be refunded upon return of same. Fred I. Sutton is Mayor.

MORGANTON, N. C.—Plans have been completed, it is reported, by H. L. Milliner, engineer, for the construction of dam and power house on the Catawba River, to develop 6000 hp, and on the Henry River, to

develop 4000 hp. It is proposed to transmit electricity generated at the plants to Morganton, Drexel, Valdese and Connelly Springs.

SPARTANBURG, S. C.—The South Carolina Lt., Pwr. & Rys. Co., of Spartanburg, has closed a contract with the Pacolet Mfg. Co. to furnish energy to the amount of 750 hp to operate its mills, and also a contract to supply the Southern Marble & Granite Co. with 500 hp for its plant.

UNION, S. C.—Proposals will be received by R. A. Easterling, engineer, care of the Commissioners of Public Works, 17 West Main Street, Union, until March 30 for furnishing machinery and material for water-works extensions and erection of transmission line as follows: 160 35-ft. (8-in. top) cypress poles, 160 24-in. Bo-Arrow arms with pins and bolts, 500 6600-volt porcelain insulators, six 20-kw, 6600/2200-volt transformers, one 75-hp induction motor and 3500 lb. No. 8 copper wire; also one 400-gal.-per-minute centrifugal pump, 4-in., 6-in. and 8-in. cast-iron pipe, pig lead, cast-iron specials, gate valves and boxes, and double-nozzle hydrants. Specifications may be obtained from the engineer at Union, upon payment of $5, to be refunded upon return of same.

VALDOSTA, GA.—Plans and specifications, it is reported, are being prepared for the South Georgia Pwr. Co., recently incorporated with a capital stock of $2,500,000, for the construction of a hydroelectric plant on Withlocoochee River, 4 miles from Valdosta. Electricity generated at the plant will be transmitted to Valdosta, Quitman, Camilla and other towns in this part of the State. Frank Roberts is in charge of the project.

ST. PETERSBURG, FLA.—The proposal to issue $150,000 in bonds to establish a municipal electric-lighting plant will be submitted to the voters.

DRESDEN, TENN.—Preparations are being made for the installation of a municipal electric-light plant in Dresden, to cost about $10,000. Bids for machinery are now being received. Philip Porter, of Clinton, Ky., is engineer in charge.

BIRMINGHAM, ALA.—Plans are being considered by the Alabama Pwr. Co., of Birmingham, for extensive improvements and extensions to its system, involving an expenditure of about $2,000,000. The plans provide for extensions to transmission lines and improvements to operating properties as follows: steam plant at Anniston; steam plant near Gadsden; hydroelectric plant at Lock 12 on Coosa River; hydroelectric plant at Jackson Shoals on Choccolocco Creek, near Talledega; hydroelectric plant on Big Wills Creek, near Attala. James Mitchell, 100 Broadway, New York, N. Y., is president.

JACKSON, MISS.—At an election held March 13 the proposal to issue $160,000 in bonds for the installation of a municipal electric-light plant was defeated.

NEWPORT, ARK.—The Arkansas Lt. & Pwr. Co., of Arkadelphia, it is reported, contemplates improvements to the property of the Co-operative El. Lt. Co., to cost from $20,000 to $25,000, which it has recently acquired.

BRYAN, TEX.—Plans are being considered for extension to the municipal electric-lighting system.

GENTRY, TEX.—Estimates, it is reported, are being prepared for the installation of a municipal electric-light plant and water-works system in Gentry. The city may purchase the local plant and improve the same.

MISSION, TEX.—The City Commissioners have granted Hamilton & Horlock, of Houston, a franchise to install an electric-lighting plant and water-works system. The cost of the system is estimated at $60,000.

TERRELL, TEX.—Plans are being prepared, it is reported, for equipping the Texas Midland Railroad, which runs from Paris to Ennis, a distance of 135 miles, for electrical operation. It is proposed to convert the railway into an interurban line for both freight and passenger traffic. The construction of an extension to Waco and a branch line to Dallas is under consideration. E. H. R. Green, of New York, is president and general manager.

Pacific States

SEATTLE, WASH.—The city utilities committee of the City Council has recommended an ordinance appropriating $25,000 for the installation of an additional boiler in the Lake Union auxiliary steam plant of the municipal lighting system, increasing the output to a maximum of 10,000 kw.

SPOKANE, WASH.—The Washington Wtr. Pwr. Co., of Spokane, is contemplating extending its transmission line from Endicott to Winona and La Crosse this spring.

TACOMA, WASH.—The City Council has authorized Mr. Savage, engineer of the City Light and Water Department, to investigate sites on the Nisqually River, above the present plant, for available storage capable of being used to increase the output of the Nisqually plant to its full capacity the year around. If no additional storage can be found, it will be necessary to build a steam auxiliary plant to enable the present station to meet the demands made upon it.

LOS ANGELES, CAL.—Bonds to the amount of $7,000 have been voted by the citizens of the Homeward Avenue lighting district for the installation of a lighting system on Main Street from Ninety-second Street to Athens-on-the-Hill.

LOS ANGELES, CAL.—Application has been filed with the State Railroad Commission by the Southern California Edison Co., of Los Angeles, for permission to issue $2,500,000 in debentures, of which the proceeds of $500,000 will be used for extensions and improvements to its system and service in the Southern California counties.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 30, for furnishing at the navy yard, Mare Island, Cal., naval supplies as follows: Anchors and balancing bands, annunciators, steam blowers, feed waters, gongs, hoists, lamp-black, electric whistle outfit, copper pipe, steel, thermostats, rudder angle transmitter, unions, etc.

HUNTINGTON, UTAH.—A company has been organized here under the name of the Huntington El. Lt. & Tel. Co. to construct and operate an electric light and power plant in Huntington. The site of the proposed plant has been decided upon and construction work will soon begin. M. Jensen is president and Byron Howard is secretary of the company.

PARK CITY, UTAH.—The Heber Lt. & Pwr. Co., of Heber, has submitted a proposal to the City Council offering to supply electricity in Park City. The plan proposed provides for the erection of a steel-tower transmission line from Heber to this city and the installation of a distribution system. A committee has been appointed to investigate the proposition.

PAROWAN, UTAH.—The Iron County El. Lt. Co., of Parowan, recently incorporated, proposes to install an electric-lighting plant here. T. J. Yates, engineer, of Salt Lake City, and James Ollerton, of Parowan, are interested in the project.

DEER LODGE, MONT.—Plans have been completed for the installation of an ornamental lighting system in Deer Lodge, which provide for the erection of 62 metal standards, carrying three-lamp clusters (one 100-cp and two 60-cp lamps), maintained by underground wire, to cost about $60,000. Contract for standards will be awarded March 29. Contracts for wiring will be let later. P. Pauley is chairman of lighting committee.

PHILLIPSBURG, MONT.—Bids will be received by the city clerk until April 5 for lighting the streets, alleys and public buildings.

DUBOIS, WYO.—Within the next six months the Lander El. Lt. & Pwr. Co., of Lander, expects to erect a complete electric generating station and distribution system in the town of Dubois, Wyo. Complete equipment will be purchased, excepting waterwheel and generators, which the company has on hand. For further information address E. D. Edwards, manager, P. O. box 583, Lander.

CRESTED BUTTE, COL.—The proposal to issue $15,000 in bonds for the purchase and improvements to the local electric-light plant will be submited to the voters on April 6. The town also proposes to take over the water-works system.

Canada

KAMLOOPS, B. C.—A by-law to authorize an expenditure of $80,000 for hydroelectric purpose has been introduced into the Council.

BRANTFORD, ONT.—The Council has passed the by-law authorizing an appropriation of $30,000 for the purpose of supplying the street-railway system with hydroelectric power. It is now operated by energy supplied by the Western Counties Pwr. Co.

MONTREAL, QUE.—The report of the Board of Commissioners asking for $550,000 to add several sections to the area of underground conduits has been adopted by the City Council.

MONTREAL, QUE.—Bids will be received by the city of Montreal until April 6 for furnishing and installing lamps and lamp standards, with concrete foundations for same, for the street-lighting system on St. Catherine and Bleury Streets, to be maintained by underground wires. Specifications may be obtained at the office of the superintendent of purchases and [illegible]les, City Hall, Montreal.

Miscellaneous

CORDOVA, ALASKA.—The franchise granted some time ago to H. H. Knox, of Cordova, for an electric-light plant here, it is reported, has been transferred to a corporation organized under the laws of the State of Washington, known as the Alaska-Electric Consol. Co. The necessary capital to install the plant at Power Creek, Lake Eyak, 7 miles distant, and the erection of a transmission line to this city, has been assured. George F. Russell, E. L. Terry, N. W. Higgins and DeVillo Lewis, of Seattle, Wash., are among the directors.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 16, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,131,651. THERMOSTAT; G. C. Andrews, Minneapolis, Minn. App. filed March 20, 1912. For furnace control.

1,131,668. ATTACHMENT FOR SPEED RECORDERS; C. A. Bowden and J. F. Gordon, Garrett, Ind. App. filed March 30, 1914. For locomotives; novel binding-post construction.

1,131,673. SIGNALING SYSTEM FOR TRAIN DISPATCHING; S. Brown, Brooklyn, N. Y. App. filed March 31, 1911. For sending "time."

1,131,683. AUTOMATIC FUEL-CONTROL SYSTEM FOR BOILERS; J. A. Doble, Waltham, Mass. App. filed Jan. 28, 1914. Electric igniter in place of usual pilot.

1,131,717. COMBINED ELECTRIC RAILWAY AND SIGNAL SYSTEM; P. W. Leffler (deceased), Chicago, Ill. App. filed Aug. 13, 1908. Has automatic rheostats controlled by cars.

1,131,723. LOCK ATTACHMENT FOR SOCKETS; R. V. Miller and J. A. Molin, Yonkers, N. Y. App. filed May 8, 1914. Attachable to ordinary socket.

1,131,724. ELECTRIC-LAMP SOCKET; C. B. Mills, Baltimore, Md. App. filed Sept. 24, 1913. Designed for temporary connection to a cable.

1,131,734. LINE SWITCH; J. N. Reynolds, Greenwich, Conn. App. filed May 10, 1913. For serving large groups of lines.

1,131,770. SIGNAL SYSTEM; G. Brown, Sarnia, Ontario, Canada. App. filed March 29, 1911. Alarm sounds when engineer fails to properly execute the order of the pilot.

1,131,811. SELECTOR FOR MACHINE SWITCHING TELEPHONE SYSTEMS; F. Allendorff, Antwerp, Belgium. App. filed Dec. 28, 1912. Telephone user can automatically obtain connection with a free trunk.

1,131,813. ELECTRIC ANNUNCIATOR OR CODE SIGNALING DEVICE; N. L. Anthony, Cranston, R. I. App. filed Feb. 2, 1914. Call-board construction.

1,131,824. ALARM DEVICE FOR MOTOR VEHICLES; F. E. Cline and W. L. Baskerville, San Diego, Cal. App. filed Nov. 17, 1913. Sounds alarm when attempt to steal car is made.

1,131,831. TROLLEY BASE; C. E. Gierding, Mansfield, Ohio. App. filed March 5, 1913. Readily interchangeable construction.

1,131,832. APPARATUS FOR OPERATING BULKHEAD DOORS; H. M. Gleason, Philadelphia, Pa. App. filed Aug. 21, 1906. Manually or by electric control.

1,131,855. INDICATING DEVICE FOR ANNUNCIATORS AND THE LIKE; M. Nordoff, Chicago, Ill. App. filed May 12, 1911. Includes solenoid with longitudinally movable oscillating core.

1,131,859. ELECTROLYTIC APPARATUS; C. A. Parks, Chicago, Ill. App. filed Sept. 14, 1914. For commercial production of hydrogen and oxygen by decomposition of water.

1,131,870. POLYPHASE X-RAY SYSTEM; H. C. Snook, Philadelphia, Pa. App. filed Dec. 26, 1908. Producing very intense X-rays.

1,131,896. ALTERNATING-CURRENT RECTIFIER; E. C. Ballman, St. Louis, Mo. App. filed Jan. 3, 1911. Electromagnetic type for charging storage batteries.

1,131,910. VACUUM DISCHARGE FOR LIGHTING PURPOSES; C. Claude, Paris, France. App. filed Feb. 27, 1911. Utilizes luminescent properties of neon.

1,131,911. CALL-DISTRIBUTING TELEPHONE SYSTEM; H. P. Clausen, Rochester, N. Y. App. filed June 26, 1911. Combined with regular common-battery multiple-manual system.

1,131,912. TELEPHONE SYSTEM; H. P. Clausen, Rochester, N. Y. App. filed March 11, 1912. Species of partial call-distributing system.

1,131,914. ELECTRICAL INSTALLATION FOR LIGHTING, HEATING AND VENTILATING RAILWAY CARRIAGES AND SIMILAR PURPOSES; A. H. Darker, Blackheath, Eng. App. filed Nov. 5, 1912. Special rocking reversing switch construction.

1,131,919. ALTERNATING-CURRENT RECTIFIER; E. Fassler, Frankfort-on-the-Main, Germany. App. filed Oct. 29, 1909. Vibrating rectifier for charging purposes.

1,131,920. ALTERNATING-CURRENT RECTIFIER; E. Fassler, Frankfort-on-the-Main, Germany. App. filed Nov. 5, 1910. Obtains impulses greater in one direction than in other for charging purposes.

1,131,921. MAGNETO APPARATUS; R. Fischer, Frankfort-on-the-Main, Germany. App. filed Jan. 29, 1913. Parallel arrangement of two similar armatures in a common magnetic-pole system.

1,131,968. ELECTRO-PNEUMATIC BRAKE DEVICE; W. V. Turner, Edgewood, Pa. App. filed Nov. 10, 1910. For traction cars; upon movement of cut-out switch, the electric control device is prevented from causing application of the brakes.

1,131,971. ELECTRO-PNEUMATIC BRAKE MECHANISM; W. V. Turner, Edgewood, Pa. App. filed Sept. 10, 1912. Special valve mechanism.

1,131,979. RAILWAY - TRAFFIC - CONTROLLING APPARATUS; F. J. Ackerman, Pittsburgh, Pa. App. filed Nov. 11, 1912. Electric interlocking switch system.

1,131,980. RAILWAY - TRAFFIC - CONTROLLING APPARATUS; F. J. Ackerman, Pittsburgh, Pa. App. filed Nov. 11, 1912. Switch system, embodying devices responsive to reversals of current.

1,131,981. RAILWAY - TRAFFIC - CONTROLLING APPARATUS; F. J. Ackerman, Pittsburgh, Pa. App. filed Nov. 11, 1912. Embodies polarized relay and pole changer.

1,131,982. CIRCUIT-CONTROLLING DEVICE; F. J. Ackerman, Pittsburgh, Pa. App. filed Nov. 11, 1912. Polarized relay with polarized armature and neutral locking armature.

1,132,008. ELECTRIC LAMP; L. A. Hawkins, Schenectady, N. Y. App. filed Nov. 29, 1907. Arrangement by which if one lamp burns out other lamp is illuminated.

1,132,012. ELECTRIC PENDULUM CLOCK; A. Jabs, Zurich, Switzerland. App. filed Oct. 16, 1912. Armature is fixedly connected to the forked pendulum crutch.

1,132,016. MEANS FOR FORMING ZONES OF VARYING AND VARIABLE STRENGTHS IN MAGNETIC FIELDS; A. F. Jobke, Wilkinsburg, Pa. App. filed Jan. 24, 1912. Formation of magnet poles.

1,132,087. OUTLET BOX; W. A. Hall, New York, N. Y. App. filed April 27, 1912. Water-tight knock-out construction.

1,132,091. LANTERN; G. W. and E. A. Hellstrand, Chicago, Ill. App. filed May 16, 1913. Self-contained battery and electric lamp for mounting in an ordinary oil lantern.

1,132,094. CONTACT MEMBER; W. F. Hosford, West Chicago, Ill. App. filed Sept. 8, 1911. Welded platinum contact point.

1,132,103. FIRE ALARM; D. McClanahan, Stacy, Va. App. filed March 20, 1914. Springs held by strands severable by heat.

1,132,106. SIGNALING SYSTEM; H. B. Mead and H. F. Guentzler, Cleveland, Ohio. App. filed Oct. 24, 1910. For calling foreman or other party wherever he may be in a factory.

1,132,107. AUTOMATIC TELEPHONE SYSTEM; F. Merk, Charlottenburg, Germany. App. filed Aug. 25, 1911. Selectors and connector operate without a so-called side switch.

1,132,108. DIRECTORY BOARD; A. Merk-Wirz, Zurich, Switzerland. App. filed June 18, 1913. Lamps indicate on map present location and location of point desired.

1,132,116. CUT-OUT BOX; A. L. Pierce, Wallingford, Conn. App. filed May 27, 1914. Special construction for mounting on pole.

1,132,128. APPARATUS FOR SAFEGUARDING AUTOMOBILES FROM THEFT; O. A. Smith, Springfield, Mass. App. filed May 12, 1913. Movement of gear shift lever imparts shock and sounds alarm.

1,132,144. DYNAMO-ELECTRIC MACHINE; C. E. F. Ahlm, Cleveland, Ohio. App. filed Feb. 14, 1910. For train lighting. (Forty-nine claims.)

1,132,145. DYNAMO-ELECTRIC MACHINE; C. E. F. Ahlm, Cleveland, Ohio. App. filed May 16, 1910. Directs lines of force by magnetic leakage.

1,132,154. ELECTRIC PULL SWITCH; C. A. Billey, Cripple Creek, Col. App. filed Jan. 28, 1914. Weatherproof; for mine use.

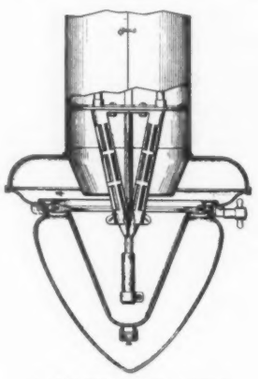
1,132,173. FLASHLIGHT; A. J. Dupont, Adams, Mass. App. filed March 19, 1914. Attachable to the back of the hand.

1,132,183. BATTERY SEPARATOR; C. P. Hidden, New York, N. Y. App. filed Aug. 5, 1910. Porous mass of pulverulent inert material.

1,132,186. TRAFFIC SIGNALING SYSTEM; E. W. Kelley, Rochester, N. Y. App. filed Dec. 29, 1913. For pointing out route to be taken by fire apparatus, etc.

1,132,245. FIRE-ALARM SYSTEM; J. B. Ammons, Houston, Tex. App. filed Dec. 8, 1914. Embodies a cannon which fires a projectile normally holding the contacts separated.

1,132,249. SIGNALING DEVICE FOR PARTY TELEPHONE LINES; L. Ericson, Chicago, Ill. App. filed Nov. 15, 1906. Harmonic ringer adapted to be placed in box of ordinary subscriber's set.



1,132,307—Arc Lamp

1,132,259. INCLOSED-ARC LAMP; C. A. B. Halvorson, Jr., Saugus, Mass. App. filed June 30, 1913. Gases caused to deposit solidifiable products above the globe.

1,132,262. METHOD OF TREATING METAL STRUCTURES TO PREVENT SUBSEQUENT CHANGE IN FORM; J. O. Heimze, Jr., Detroit, Mich. App. filed April 9, 1912. Magnetically agitates the molecules of the metal before the casting is fashioned.

1,132,267. ELECTRIC SIGNALING APPARATUS AND CIRCUITS; F. B. Herzog (deceased), New York, N. Y. App. filed Aug. 15, 1890. Transmitter.

1,132,281. REACTIVE COIL; W. S. Moody, Pittsfield, Mass. App. filed July 11, 1912. In the shape of two cones joined at their bases.

1,132,294. ELECTRIC COUPLING OR CONNECTOR; J. Wilkie, Crosshill, Glasgow, Scotland. App. filed May 21, 1913. Protected binding-post construction.

1,132,297. ELECTRICAL EQUIPMENT FOR INTERNAL-COMBUSTION ENGINES; V. G. Apple, Dayton, Ohio. App. filed Sept. 9, 1912. Induction device bodily carried on the spark plug.

1,132,299. ELECTRIC FLATIRON; H. P. Ball, Pittsfield, Mass. App. filed June 23, 1912. Has plug which is oscillated to make and break circuit.

1,132,304. BRUSH-HOLDER AND TERMINAL FOR CONNECTING ELECTRIC CABLE; R. H. Cunningham, New York, N. Y. App. filed Dec. 21, 1912. Protected against moisture and dirt.

1,132,307. ARC LAMP; J. T. H. Dempster, Schenectady, N. Y. App. filed May 17, 1912. Separate fusible bar of light-giving materials is fed into engagement with electrodes.

1,132,308. GRAPHIC RECORDING APPARATUS; J. T. Dempster, Schenectady, N. Y. App. filed Oct. 20, 1913. Combined with electric meter.

1,132,313. FLAME-ARC LAMP AND ELECTRODE THEREFOR; G. Egly, Berlin-Treptow, Germany. App. filed Sept. 9, 1914. Negative electrode embodying exclusively salts of the alkalis.

1,132,322. ELECTRICAL MEASURING INSTRUMENT; A. J. R. Fiego, Lynn, Mass. App. filed July 9, 1913. Usable either as voltmeter or ammeter.

1,132,355. SYSTEM OF ELECTRICAL WIRING; W. J. Kistler, Coopersburg, Pa. App. filed Oct. 3, 1913. Metal-molding construction.

1,132,388. COUPLING OR SPLICE FOR TROLLEY WIRES; G. W. Robinson, Baltimore, and M. E. Harding, Odenton, Md. App. filed May 12, 1914. Provides a smooth underrun for the trolley.

1,132,394. MANUFACTURE OF CHEMICALLY PURE SOLUBLE SILICIC ACID; B. Schwerin, Frankfort-on-the-Main, Germany. App. filed April 18, 1914. Subjects alkaline silicate solution to action of electric current.

1,132,404. ELECTRO-PNEUMATIC SOUND BOX; C. Stille, Berlin, Germany. App. filed April 24, 1913. Sound-transmitting electromagnet controls blast of air through sound box.

1,132,419. AUTOMATIC FIRE-ALARM SYSTEM; J. B. Ammons, Houston, Tex. App. filed Dec. 8, 1914. Thermostat operable by fire near at hand or at any point in the system.

1,132,427. ELECTROMECHANICAL SYSTEM TO AVOID RAILWAY COLLISIONS; A. Beer (deceased), Venice, Italy. App. filed June 21, 1909. Impossible to set starting signal unless track is clear.

1,132,442. X-RAY TUBE; M. S. Clawson, Weehawken, N. J. App. filed Sept. 9, 1913. Copper anode with tungsten button.

1,132,444. CIRCUIT CONTROLLER; J. P. Coleman, Edgewood Borough, Pa. App. filed Aug. 5, 1912. Matching teeth on peripheries on the insulating sleeves and on the hubs of the contact segments.

1,132,445. ELECTRIC MOTOR; J. B. Conrad, Nicolaus, Cal. App. filed July 2, 1913. Solenoid engine.

1,132,451. MULTIPLE-CONDUCTOR ELECTRICAL CABLE; C. W. Davis, Edgewood, Pa. App. filed Jan. 14, 1914. Has insulating envelope of rolled or wrapped paper.

1,132,452. MULTIPLE-CONDUCTOR CABLE; C. W. Davis, Edgewood, Pa. App. filed Jan. 14, 1914. High-tension, three-strand.

1,132,454. BINDING POST; F. H. Day, Dawson, Yukon Territory, Canada. App. filed Sept. 3, 1913. For taking a number of wires.

1,132,470. SWITCH; D. D. Gordon, Chicago, Ill. App. filed April 30, 1912. Push-button construction.

1,132,473. CIRCUIT CONTROLLER; C. O. Harrington, Edgewood Borough, Pa. App. filed Sept. 5, 1913. Segment and fixed-brush construction.

1,132,478. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Johnson, Milwaukee, Wis. App. filed Sept. 16, 1910. For storing and giving up of kinetic energy.

1,132,485. GAS-LAMP CONTROL AND IGNITER; W. F. Oeftger, Detroit, Mich. App. filed March 9, 1914. For automobile gas lamps.

1,132,499. FIRE-ALARM SYSTEM; N. H. Suren, Needham, Mass. App. filed March 7, 1912. For large manufacturing establishments, etc.

1,132,500. TERMINAL CLIP; L. A. Thomas, Evansville, Ind. App. filed June 5, 1914. Spring clip formed from single length of wire.

1,132,523. MANUFACTURE OF INCANDESCENT FILAMENTS OF METALLIC TUNGSTEN OR MOLYBDENUM FOR ELECTRIC INCANDESCENT LAMPS; A. Lederer, Vienna, Austria-Hungary. App. filed Aug. 25, 1906. Powdered tungsten and camphor.

1,132,525. CONTROLLER REGULATOR; J. Y. Porter, Detroit, Mich. App. filed May 23, 1914. Action of controller is restrained to a slow movement.

1,132,532. PORTABLE ELECTRIC-LAMP STAND; A. Bouchery, New York, N. Y. App. filed Aug. 22, 1914. Adaptable for use in various locations and readily disassembled and packed.

13,891 (reissue). TELEPHONE - EXCHANGE SYSTEM; S. H. Browne, Short Hills, N. J. App. filed Sept. 30, 1914. (Original patent, No. 1,073,589, dated Sept. 23, 1913.) Quickened service and lowered cost.